THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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J. A. BERLY'S).

1911 EDITION

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STATE OWNERSHIP OF CABLES.

THE Imperial Conference has done good service in deciding upon a policy with respect to the moderation of cable rates throughout the Empire, and although the decision arrived at falls short of what might reasonably have been expected, the negotiations have resulted in progress towards the cheapening of telegrams and cablegrams within the King's dominions. Australia entered a plea for the complete control of all the telegraphic and cable lines along the All-Red route, by the Pacific Cable Board. New Zealand was in favour of establishing a chain of State-owned wireless stations, and in addition a State-owned cable between Canada and the Mother Country; but the main purpose of all concerned was to obtain respite from the exorbitant charges of existing cable companies. As a result, the Conference accepted Sir Joseph Ward's motion, to the effect that all possible means should be taken to secure a reduction in cable rates throughout the Empire, and it emphasised the necessity for concentrating attention upon the Atlantic cable systems in respect of rates. Nevertheless, it hesitated to accord support to the suggestion that an Atlantic cable should be imperialised in order to cheapen the communication between Great Britain, Canada, Australia and New Zealand.

The positive advance took shape in a resolution, which was a veiled threat coupled to an open vow, declaring that if in the near future the trans-Atlantic cable rates are undiminished, the laying of a State-owned cable between England and Canada shall be considered by a subsidiary conference. This decision leaves the matter in a favourable position for negotiations by the Governments of Great and Greater Britain, but unless the question is kept alive by those who suffer from the existing cable rates, there is just a chance that in this form the resolution may be indefinitely shelved. As an earnest of their intentions, it would have been far more to the point if the subsidiary conference had been called at once, and if certain of its members had been formed into a committee to develop the details of the scheme and to report from time to time to the Governments concerned. It is noteworthy that the scheme for the laying of a State-owned cable between England and Canada did not exactly commend itself to the members of the Imperial Conference, and for the reasons that we stated a few weeks ago when contemplating such a proposal, it is not surprising that the financial aspect of the proposition failed to convince the majority of the members. In a commercial enterprise of this character the State can never hope to enter into successful competition with a private concern, and the shortcomings of the State must always be paid for by the public, in cash. The proper task for the State is to control the cables that touch upon the shores of the Empire, to the extent of preventing extortion. If, therefore, the subsidiary conference referred to in the resolution is ever called into existence, we would commend to its consideration a scheme for encouraging additional private-owned cables as an alternative to a State-owned cable scheme.

Our Tramway Table.

WITH this issue our readers will receive the sheet containing our statistical tables relating to the electric tramways, railways and power companies of the United Kingdom. We regret to note that the number of these undertakings still remains practically stationary, showing that, apart from extensions to existing systems, very little development is taking place in these directions, and the alterations necessary in the body of the tables being so much fewer than in former years, we have come to the conclusion that an annual revision is no longer required. The tables now issued, therefore, will, according to our present intentions, stand for two years, though no one would welcome more cordially than ourselves such a revival as would necessitate an earlier revision.

On similar grounds, we have decided not to issue a new edition of our Table of Electricity Works this year. We wish to convey to the engineers, managers and secretaries of the various undertakings concerned our sincere thanks for their renewed co-operation in the work of revision; without their kind assistance the work would be impossible of execution.

The Coronation Illuminations.

DURING the past few months we have recorded a great many preparations for electrical displays in different parts of the country in celebration of the Coronation. The event being now a thing of the past, not much more need be said, for every reader of an electrical paper will have observed how complete has been the success attained. The extent to which electricity was employed for illumination purposes in all parts of London and in important centres in the kingdom may have surprised some, but on the whole, we believe that the widespread advertisement that electricity has received, the large amount of work that electrical firms and electricity suppliers have been doing, and the appreciation of the excellent effect by the public everywhere, can only be a source of gratification to everybody interested in the forward march of electricity. In presence of so pleasing a result, it were unkind to refer to the inability of another illuminant to come anywhere near to what we have achieved. It is enough that in respect of the illumination of public thoroughfares and buildings, and also of the Fleet, the approval of the Press and the public is, on this occasion, practically unanimous. The advocates of gas wanted a breeze in order to secure the best possible effect—then electricity would be nowhere in comparison. Well—they got a high wind instead, with consequences upon which our usual modesty will not permit us to dwell. One result of the whole will be similar to the effect of a huge widely-distributed electrical publicity effort, the lessons of which will have been indelibly fixed in the public mind, and will bear fruit in all directions, and in all kinds of ways, for a long time to come. The firms who laid themselves out for carrying out work of this description are deserving of congratulations for some most effective schemes in which they took the fullest advantage of the possibilities of electricity. Electricity and tramway departments have by the illumination of their supply works, and of special tramcars, rendered excellent service to the general cause.

Deposit "Non-Returnable."

ONE would have thought that the time had passed by—at any rate, in the electrical world—for condemning, on account of its manifest unfairness, the practice of announcing, when inviting tenders, that the deposit is so much but the amount will not be returnable. Some authorities of standing do not ask for any deposit at all from the tenderer, others find it necessary to require one to be lodged as a guarantee of the *bona fides* of the applicant. No doubt many a wanton application by those who have no business interest in the matter is prevented by this stipulation. But it is not right to mulct manufacturers who go to the trouble and expense of tendering, to the tune of the cost of the fees to the engineer who prepares the scheme. We have got so accustomed to the deposit being returnable on receipt of tender, that we rubbed our eyes at a departure from the practice disclosed by two "Official Notices" appearing in our last issue. In both of the cases the works are for Irish authorities—one a municipality and the other a private company—and the consulting engineer is the same both at Swinford and at Charleville. The similarity between the schemes and the sections for which separate tenders may be submitted, shows that in both cases the same firms will be interested. Both undertakings are to embrace suction gas plants, gas engines, dynamos, storage batteries, switchboards, overhead lines and street lamps—a variety of manufactures these! If all of the best-known makers only were to tender, there would be quite a respectable total at a guinea apiece for each contract. We think in fairness to the electrical trade, the Charleville Electric Co. and the Swinford Rural District Council should withdraw their stipulation, and conform to what is now the thoroughly established and recognised practice in the electrical trade. The last occasion on which we had to allude to this subject was when an architect was the offending party. We hope that in the present instance the engineer will himself see the wisdom of adopting the recognised practice and bring his influence to bear in the proper quarter; for to demand a non-returnable deposit is a proceeding which ought to cease, as the nomination of the engineer as his own arbitrator has practically done in municipal electrical specifications.

The I.M.E.A. Convention.

ELSEWHERE in this issue we commence a report of the proceedings at the annual Convention of the Incorporated Municipal Electrical Association, which has been in progress during the last few days. The members are to be congratulated upon the excellent programme prepared for them, including several papers well above the average standard of merit. The President, Mr. Christie, touched upon many "live" topics in his interesting address, which we reproduce in abstract; in particular we may note the abandonment of the maximum-demand system even in its birthplace, the remarkably successful operation of the restricted-hour system in Brighton, and Mr. Christie's views on the subject of municipal hiring and wiring, which are in fair agreement with our own, and must be admitted to be founded on common-sense principles. It should be possible on these lines to arrive at a *modus vivendi* satisfactory both to the contractors and to the supply authorities, and we trust that, in the interests of the development of electricity supply, the representatives of the two bodies will see their way to an early settlement of the questions at issue between them.

Coronation Honours.

ALTHOUGH the names appearing in the Coronation Honours list that are of interest in electrical, engineering and scientific circles are very few, we are sure that the promotion of the Hon. C. A. Parsons, C.B., LL.D., D.Sc., to be a K.C.B., will have given general satisfaction. A similar honour has been conferred upon Dr. J. A. Ewing, C.B., F.R.S. To both of these distinguished gentlemen we tender our hearty congratulations. Other names in the list of new K.C.B.'s are Sir Robert Hunter and Mr. Alexander F. King, solicitor and second secretary respectively, to the General Post Office. The Right Hon. Sir C. B. McLaren, Bart., who is largely interested in steel, shipbuilding and colliery undertakings, has the dignity of Baron of the United Kingdom conferred upon him, and Mr. H. S. Leon, who is connected with several electrical companies, becomes a Baronet, as do also Mr. C. T. Mander, of Wolverhampton, and Sir Boverton Redwood, D.Sc. Mr. G. Croydon Marks, M.P. (Marks & Clerk, consulting engineers and patent agents), is made a Knight. Other honours include a C.B. for Mr. G. W. Wilcocks, M.Inst.C.E., Chief Engineering Inspector to the L.G.B., while Dr. J. R. Bradford, a secretary to the Royal Society, receives the appointment of K.C.M.G.

THE MUNICIPAL ELECTRICAL CONVENTION, 1911.

On Tuesday morning last, the sixteenth annual Convention of the I.M.E.A. opened its proceedings at Brighton, where, in the historic Royal Pavilion, a large gathering of members and visitors were welcomed by the Mayor, Councillor Thomas-Stanford.

Civic welcomes are all very much alike, and Councillor Stanford's remarks, though commendably brief, were nevertheless sufficiently eloquent of the hearty invitation which the Brighton Corporation has extended to its visitors, and which is naturally none the less cordial because the first meeting of the Association terminated in Brighton.

The Presidential address which followed is dealt with elsewhere. In passing, we note that Brighton, "a non-industrial town of 132,000 inhabitants," last year consumed some 3,000,000 power units, exclusive of traction supply, out of a total of 10,290,000 units supplied—figures which an industrial town may envy. Mr. Christie considers it essential that the supply authority should possess powers to sell and hire out apparatus for power, heating, and cooking purposes; it probably is under present conditions—but he rightly, we think, deprecates municipal wiring and selling of electric light fittings, considering, evidently, that a better use can be found for the capital which would be required.

At the termination of the address, a vote of thanks to the President was proposed by Ald. Pearson (Bristol), and seconded by Mr. C. E. C. Shawfield (Wolverhampton), and Councillor Leese (Stoke-on-Trent), then read his paper on "Electricity Supply Viewed from the Municipal Committee's Standpoint."

Mr. Frank Ayton (Ipswich) concisely expressed the general opinion that, in this case, the Chairman appeared to have taken on the duties of his engineer. Councillor Crowther (Sheffield), in common with others, deprecated the subsidising of municipal coffers from electricity pockets. After expressing his belief that a surplus was not necessarily an indication of success from the municipal point of view, for well-known reasons, he drifted on to the wiring question, and propounded the conundrum, "Who are the contractors?" While admitting that the exigencies of business tend to obscure a satisfactory reply, we are sure that the Councillor's answer, "drapers who have added a wiring department," does not do adequate justice to that much-abused fraternity.

After Bailie Willock had expatiated on the happy position of a chairman at Glasgow and caused amusement by remarking that they didn't call in consulting engineers in Glasgow, as they had had some, Mr. Fedden (Sheffield) drew attention to the effect of the policy of the L.G.B. in shortening loan periods, and forcing the supply authority to charge unduly high prices in order to provide the surplus required under these conditions. He also complained of the tactics of contractors who disguised the real conditions of their tenders by long covering letters.

Other speakers were Alderman Pearson (Bristol), Councillor Good (Maidenhead), Councillor Smith (Glasgow) and Alderman Smith (Liverpool), who disagreed with previous speakers as to the destination of electricity surpluses, and urged the claims of the general body of ratepayers, as their credit was at stake.

Mr. J. W. Beauchamp's paper on "Modern Wiring Practice," which followed, elicited a necessarily brief discussion. Evidently the problem of the small consumer, especially if his premises have to be wired, is causing many engineers to think furiously, and it is clear that the simplest and cheapest wiring systems will have to be adopted eventually. Wiring through joists, used in many places and referred to by several speakers, cannot appreciably reduce the total cost of a job in which labour and cost of wire figure so prominently. One speaker, Mr. Ayton, expressed his belief in wood casing, and advocated the rating of switches on a wattage basis.

At the conclusion of the meeting, the members and visitors, some 450 to 500 of whom are present at the Convention, were photographed in the pavilion grounds.

During the afternoon visits were paid to the Corporation generating station at Southwick, and to the "interesting plant and equipment" as the official programme has it, of the local gas company, whose works are next door. The Southwick plant, which was described in the ELECTRICAL REVIEW when it was opened in 1906, has been extended until a capacity of over 10,000 KW. in five turbine units has been reached. The four smallest sets are of the Westinghouse double-flow type, while the latest addition, a 3,000-KW. Richardsons, Westgarth-Siemens set, has only been started this year. The old North Road station is, of course, now a sub-station only, with a full complement of rotaries, motor-generators, &c., for dealing with the three-phase 8,000-volt supply from Southwick.

In the evening a largely attended reception and conversazione was held at the Royal Pavilion, when the members and visitors were guests of the Mayor and Mayoress.

Wednesday's proceedings commenced with a railway journey to Portsmouth, where, after a welcome by the Mayor—Ald. Scott Foster—at the Municipal College, papers on "Internal Combustion Engines in Power Stations," by Messrs. Howard (Barking) and Carr (Leek) were read and discussed.

In the afternoon interest centred on the visit to H.M. Dockyard, its power plant and ships. The Corporation electric lighting and tramways power stations were also thrown open to the visitors, who returned to Brighton by special train late in the evening.

Yesterday morning discussions took place on the "Purchase of Fuel," initiated by Mr. C. E. C. Shawfield (Wolverhampton), and "Street and Shop Front Lighting," opened by Mr. A. H. Seabrook (Marylebone). The afternoon was given up to visits. The Brighton Railway Co.'s locomotive shops—which, of course, are electrically driven, from the Corporation supply—attracted many visitors. Last night the annual dinner was held at the Dome; and with the holding of the annual general meeting—nowadays one of the most interesting of the series—this morning, the Convention comes to an end.

Presidential Address.

By J. CHRISTIE, Engineer and Manager, Corporation Electricity Department, Brighton.

(*Abstract.*)

TO-DAY our roll of membership has increased to a total of 407, comprising 4 Honorary, 168 Municipal, 187 Engineer, and 48 Associate Members and Associates, and, as an Association, we can justly claim to voice the opinions, on matters electrical, of practically the whole of the municipal undertakings throughout the kingdom, whilst the capital invested in machinery and plant directly under our control, and exclusive of tramway and company undertakings, has increased to the vast sum of upwards of £41,000,000.

The town of Brighton has always held a prominent place in the history of electric lighting and traction progress. The first electric railway in this country was started here in August, 1883, through the enterprise of one of our respected townsmen, Mr. Magnus Volk. This line, running along the eastern sea front, is still in successful operation, and it is worthy of note that the dynamo now driving it has been in regular daily use for upwards of a quarter of a century.

So far back as 1891 one of the earliest experiments in electric lighting in this country was carried out under the auspices of the Brighton Corporation. The installation consisted of six arcs, each lamp being run off its own separate machine. These for a time lighted a portion of the Madeira Road, and were then regarded as one of the wonders of the age.

The following year Messrs. Hammond & Co. laid down a small plant which supplied a series of arc lamps; and during these 29 years the inhabitants of Brighton have always enjoyed the use of electricity as an illuminant.

In 1891 the Corporation obtained a provisional order, and shortly thereafter commenced a two-wire continuous-current supply with underground mains, competing for business with the company. In 1893 the goodwill of the company's business was purchased by the Corporation for the sum of £5,000.

The supply business in the hands of the Corporation and under the management of your first president (Mr. Arthur Wright), continued to prosper. In 1905 the North Road works as a steam generating station was superseded by the new three-phase turbine waterside station at Southwick. The old works are now only used as a sub-station, probably one of the largest of its kind in the country at the present time, containing as it does upwards of 8,000 KW. of converting plant of various types.

To meet the continually increasing demands in the outskirts of the town, we shall shortly have again to establish sub-stations, either equipped with three-phase alternating-current plant, or self-contained engine units of the internal combustion type.

At the present time we have 5,239 customers connected to our mains, and the consumption of electricity per head of population last year amounted to no less than 78 units, which still constitutes a record for a non-industrial town of 132,000 inhabitants, and we have by no means yet reached saturation point.

Brighton was the home of the maximum-demand system of charging; this system is undoubtedly the most equitable from both

the consumer's and supplier's point of view, and for fixing prices for large lighting and power contracts it must still always form the basis of our reckoning. There is, however, no denying the fact that even here it became with certain classes—and they were in the majority—unpopular. In deference to the popular demand for an easily understood flat rate, our Council some three years ago wisely granted the concession asked for. The maximum-demand system for all new business was abolished, the rate to existing consumers who elected to retain it was at the same time raised from 7d. and 1d. to 6d. and 2d. per unit, the alternative offered being a flat rate of 4d. per unit for domestic and shop lighting, and 3d. per unit for hotels, licensed premises, churches, &c., with special rates to very large consumers of either class. To-day everyone is satisfied with the result. The consumer gets a better light, and understands how his bills are made out, whilst we, as suppliers, have participated to some extent in the saving effected by obtaining a slightly higher average price more cheerfully paid, and all round the advantages of the change to our department have far more than compensated for any theoretical loss we may have sustained by supplying a few very short-hour users on these flat rates at less than cost price.

The development of a day-load power supply on the restricted-hour basis is another phase of our business which was first introduced in Brighton. Our winter peak lighting load is some three times the normal day load, attaining its maximum shortly after 5 o'clock and lasting till about 8 p.m. To meet this plant has to be provided, and all the expense incidental to getting it ready has to be incurred, and as this charge would in any case have to be met by the lighting consumer, it follows that if the power user will arrange his hours of work so as not to materially clash with this lighting peak, we can profitably meet his requirements at all other hours at a very low rate. We have now worked up a day load of some 3,000 H.P. connected, consuming last year almost 3,000,000 units, and this has so improved our load factor that we have been able to effect most marked economies in our works costs.

Practically all the small isolated steam plants in our area have now been displaced by electric motors, and the consequent diminution of the smoke nuisance resulting therefrom is a matter of no small importance in a health resort like Brighton.

Now that electrically-operated bakers' ovens are a commercial success, this also opens up another class of business of somewhat similar character well worthy of investigation. These make demands according to size of from 25 to 100 KW., and are usually only wanted between, say, 11 p.m. and 6 a.m., when our plant and mains are otherwise comparatively idle. The first cost and cost of maintenance are by no means prohibitive, and we could well afford to cut the price per unit for this class of business to something like ½d. per unit, at which figure, I am informed, we can effectively compete with the existing methods of heating these appliances, whilst the advantages in the way of cleanliness and ease of regulation are all in favour of electricity.

In conjunction with the development of this power, heating and cooking business, it is most essential that the supply authority should also possess powers to sell and hire out motors and other suitable appliances. No hardship can be imposed on the local contractor by granting them, as in most provincial towns the average contractor is not in a position financially to establish a hiring system, and the prospective user for similar reasons is unable to purchase these accessories through the contractor.

We, in Brighton, have enjoyed these powers to sell and hire, but not to wire, since 1901. We never exercise them if there is any possibility of a consumer doing a deal through his contractor, and where we hire we have never experienced any insurmountable difficulty in arranging between the hirer and his contractor to carry out the necessary wiring. Invariably, however, we find that consumers who could afford to buy their motors outright prefer to continue to hire from us, and to have the assurance of knowing that all our stock of spares and the resources of our department are at their disposal in case of trouble. The rental we charge for motors is some 20 per cent. of prime cost, and for this we insure, clean, oil, adjust, and regularly inspect, each machine. This return with the service rendered just pays its way with a bare margin of profit, writing off the cost in 10 years, but the department undoubtedly gains by the increased sale of energy and the satisfaction we are able to afford our consumers, and doubtless in turn this policy must be extended to the hiring of heating and cooking appliances, which are daily coming into more general use.

As a matter of equity, these powers should be granted to all undertakers who seek them, and the fact that the money necessary to put them into force can only be raised after a Local Government Board inquiry has been held is, I think, sufficient guarantee that they will not be abused. No fewer than 28 undertakings, involving a capital outlay of upwards of £11,000,000 sterling, already possess them, and this is a very strong argument in favour of our legislation being revised so as allow of all authorities being treated alike.

I am not in sympathy with municipal authorities carrying out wiring, supplying and selling electric light fittings, themselves except under very exceptional circumstances. In my opinion a supply authority can no more afford to ignore the existence of *bonâ fide* contractors than these firms can afford to take up an attitude hostile to the interests of the supply undertaking, and by friendly co-operation much unnecessary expense in the way of elaborate showrooms, canvassing and publicity organisation can often be saved without detriment to the undertaking in any way. In certain instances this so-called business-getting has been overdone. A suitable showroom to interest consumers and to demonstrate the use of the latest novelties in systems of lighting, power, heating and cooking apparatus, is most desirable, and if judiciously operated in conjunction with the collector's office, it forms one of the most valuable advertisements an undertaking can possess, but I do not consider that it is by any means always necessary to actually sell the goods to ensure success.

All undertakings where possible should have the collection of their accounts in their own hands. Some three years ago we took over the collection of our own accounts, and the results have been most satisfactory in every way, whilst the bad debts have been reduced by no less than 60 per cent.

A capable engineer as publicity officer, to assist and advise consumers free of cost as to the lay-out of their installations to the best advantage, is also a necessity in all well organised undertakings, and this is a branch of our business in which at the present time there is a dearth of suitable men; I would urge young engineers who possess the necessary personal qualifications to specialise in this department, as undoubtedly there will be lucrative appointments of this sort for competent men amongst our larger undertakings in the near future as this power, heating and especially cooking, business continues to develop.

By all means keep your wares well before the public eye; believe in them yourselves; do all you can to persuade others to believe in them; induce your Committees to lay mains broadcast and of ample section wherever there is any reasonable prospect of business resulting; have a simple easily understood tariff as cheap as circumstances will permit; and lastly, if possible, keep friendly with and assist the local contractor, and do not hamper him with harsh and unnecessary restrictions; then business of the right sort will, I am sure, come along almost automatically and just as fast as is good for your undertakings.

The Electricity Supply Publicity Committee is doing most useful work in looking after your interests in many ways. I cannot too strongly urge all municipal authorities to afford this Committee every possible support and assistance in their power.

Electricity Supply viewed from the Municipal Committee's Standpoint.

AFTER reading Councillor Leese's paper on this subject through several times, and sitting down to think about it, it seems to us a pity that the author has not said more about the subject from the point of view of *any* Committee, and perhaps less from the point of view of his own particular Committee.

A Committee and its chairman should not be too technical. The chairman should, if possible, possess an elementary or business knowledge of the commoner electrical units, and their relation to one another, and as Councillor Leese has stated in his paper, it is very necessary that he should be able to put the reports of his engineer, which may be, and often are, of too technical a nature to be easily understood by the ordinary lay-Committeeman, into such language that they may be understood, and their points properly appreciated by a Committee, the members of which should be men of sound business instincts. We would congratulate Councillor Leese on making one point at least which seems to have escaped the notice of most engineers; this point is that he heartily agrees that it would be far better to use the term "units utilised in distribution," in place of the term "units unaccounted for," because Stoke-on-Trent is not the only place within our knowledge where very awkward questions have been raised, and questions which require a lot of satisfactory answering in the Council meeting have followed the presentation of the annual report.

Councillor Leese goes into a great deal of very interesting matter in connection with the electrical view of the federation of the six Pottery towns; as an example of what has happened in a particular case it is exceedingly interesting, and no doubt the Borough of Stoke has done that which, after mature consideration of all the circumstances arising, will perhaps make for the greatest future good of the undertakings now consolidated; but we should have preferred it if Councillor Leese had condensed his remarks on this particular happening, and given the Convention some more of the sound common sense with which he began. It is very nice for the engineer, as well as for the burgesses of the town, that the chairman of its Electricity Committee should have studied the question so deeply that he thoroughly understands most of the technical points in such an electrically abstruse matter, but as a generality it is for the highest good of the undertaking that a Committee, and more particularly its chairman, should be able to gauge from a commercial or from a purely pounds, shillings and pence point of view, the merits of any scheme or schemes of this nature, which its own

engineer or other technical adviser may put before it. Neither the Committee nor any individual member of it should set up its or his opinion against that of the engineer on purely technical points, but the engineer should be able to look to his chairman, and through him to the Committee, for guidance and assistance in all matters of finance and development of the undertaking, as viewed from the ordinary standpoint of its success, or otherwise, as a commercial enterprise.

Having got over the weakest part of the paper as a paper, the author then shows that he thoroughly understands when it is necessary to make extensions of plant, a point concerning which a great many committees err, some in being too liberal with the amount of plant they put in, but more by putting off, what is to them an evil day, too long. After this Councillor Leese gets on to very debatable ground; his opinion in general as expressed at the beginning of the paragraph is sound enough, but it is not everyone who will agree with him as to the methods he proposes for dealing with what he calls "extra profits." It will be generally agreed that the consumers should have the benefit, but whether by extra discount or not is a point on which there will be very nearly as many opinions as there are undertakings. Against the argument that the ratepayers as a body should have any profit, because the rates are mortgaged as a security for those industrial concerns, there is the opposite argument that all the interest and repayment of principal charges should be spread over the whole of the ratepayers just as the cost of any municipal improvement, such as a public park or other thing of like nature, is spread over the whole of the ratepayers, it being argued that electricity supply is just as much an improvement as a public park, and the argument that not everyone wants to use electric light is met by the answer that it is not everyone who wants to walk in a public park. As regards the fairness or otherwise of the large manufacturer receiving the benefit of the reduction on his rates, it is simply a question whether the charges he pays for his electricity supply have been fixed on a commercial basis or not. In this particular case Councillor Leese seems to lose sight of the fact that while a manufacturer may pay a very low price per unit, he may yet be an exceedingly profitable consumer to the undertaking.

On the vexed questions raised by the no-profit clause in the Potteries Federation Act, Councillor Leese is quite sound in his paper; he may be consoled by the knowledge that there are fanatics on other Councils besides his own. We are very glad that Councillor Leese has inserted the paragraph relating to the fact, which is so obvious to engineers, and so hard to be understood by many members of the Committee, that the cost price of giving a supply is not the average price per unit, and, writing in advance of the meeting, one hopes that in the discussion on the paper this point will be elaborated once more for the benefit of those members of municipal committees who have not already been convinced; may they be so convinced that they will go home and convince their brother members on the point, and thus, without any doubt, make the path of their engineer more rosy. Councillor Leese makes a good point when he speaks of the minimum price at which it is profitable to supply energy, and it seems quite a sound argument that, even if cheap units are looked on as a by-product, they should certainly bear their proportion of interest and sinking fund on any mains laid solely for their distribution.

On the matter of showrooms the author seems to be in conformity with the general opinion, but his Committee remains to be convinced on a point which most engineers and committees have agreed is greatly to the advantage of towns much smaller than are the federated Pottery towns now. Stoke is to be congratulated on having contractors with whom the supply authority can work in harmony and who do their utmost, both for their own interest and for that of the undertaking. At the end of the paper Councillor Leese sounds the only warning note on the subject of electrical cooking on a general scale, but we are of opinion that although in particular areas of particular districts this trouble will be found, yet there will be many areas where a great deal of electrical cooking can be taken on, and a large number of units sold for this purpose before any trouble of a serious nature is experienced with voltage drop.

In conclusion, the paper as a whole was one likely to promote a good and healthy discussion, and beyond the previously expressed wish that less of the paper had been devoted to the special circumstances of one town, and a little more general matter had been substituted therefor, there is nothing in it to criticise adversely.

Electricity Supply viewed from the Municipal Committee's Standpoint.

By COUNCILLOR LEESE, J.P., Chairman of the Stoke-on-Trent Electricity Committee.

(*Abstract.*)

IT fell to the lot of the writer, as the chairman of the Electricity Committee of the district formed by the Federation of the six Pottery towns, to have to consider what steps should be taken to deal with the immediate future needs of that moderately large area.

Pending the amalgamation of interests, no extensions of plant were made at the individual electricity works owned by the different boroughs and urban districts combined by this order. These were six in number, Burslem, Fenton, Hanley, Longton, Stoke and Tunstall, of which four owned electricity works; there was a difference in the pressure of supply between the three continuous-current systems, while the fourth was single-phase alternating, supplying consumers at 100, 200 and 400 volts.

The aggregate winter peak load in 1910 considerably exceeded the plant capacity available, after allowing for reasonable and necessary spare machinery, and the round figure of 3,000 KW. total reached just before Christmas, was only carried with difficulty, in two of the four power stations.

The Committee decided not to make additions to the small plant in the existing stations, but to build and equip a new power station, as nearly as possible in the centre of the area of supply. The scheme comprises a central power station (which will be connected with the four existing stations by trunk mains) containing two 1,500-KW. turbo-alternators with the necessary equipment of boilers, switchboards, &c.

The intention of the Committee being to use the existing D.C. plant at Burslem and Stoke, and the A.C. single-phase at the Hanley works, so long as it is economical to do so, and to supplement it with power in bulk from the central station, the four existing works will be equipped with rotary or motor-converters for the D.C. and motor-generators for the A.C. systems. Then, during heavy loads, the local steam plant will assist the new power house, and on light loads the supply can, if found desirable, be taken in bulk from the latter.

The writer has always been of the opinion that in all industrial concerns owned and controlled by any Corporation, a price should be fixed for the particular commodity they have for sale sufficient to realise a sum which will provide all working expenses, interest on and repayment of capital, depreciation, and build up a reserve fund to meet unforeseen contingencies. If during any year's working a profit is made over and above what will provide for the above items, some arrangement should be made to give the consumer the benefit.

When the six Potteries towns were federated, a clause was inserted in the Federation Act which compels the Gas and Electricity Committees in that area so to conduct the various works that no profit shall be made which can be handed over in reduction of rates. In the event of a profit being made in any one year, the price of electricity and gas shall be so adjusted as to absorb that profit.

In dealing with "cost price" it is difficult to convince a council that the average price is not the cost price of electricity. Owing to this, the non-manufacturer too often jumps to the conclusion that manufacturers are supplied below cost when the power rates are low, and low simply because the hours of use are long. Low average does not always go with the lowest rate of charge for any given class of supply.

It is unfortunate that none of the published tables give particulars showing the price for lighting and power separately.*

In portions of Stoke-on-Trent area, large power users get supply at ½d. per unit. This figure is sufficient to cover the cost of generation, but it does not allow for sinking fund and interest on mains. Restricted-hour supply for all purposes at 1d. has been given in one of the writer's districts since March, 1906, and has met with encouraging success.

A showroom in a central position can be made a very useful adjunct to the electricity undertaking. In smaller areas, the writer thinks the best method of getting consumers, and increasing the output at the works, is to employ a canvasser—the very best type of man it is possible to get, as everything in such cases depends on this.

A great deal can be done in the direction of canvassing by cordial co-operation between the local contractors and the Corporation. In Hanley some six years ago an attempt to work together was made which has succeeded beyond expectations. The contractors were given supply at 1d. per unit, all Corporation wiring is done by them, and they are lent any apparatus required for demonstration, while in special cases they are paid a commission. As a consequence, the electrical industry is in line and pulling together without friction and with advantage to the community.

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* The ELECTRICAL REVIEW List of Electricity Works gives these particulars.—EDS. E.R.

PROCEEDINGS OF INSTITUTIONS.

Automatic Telephone Exchange Systems.

By W. AITKEN, M.I.E.E.

(*Abstract of paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS, *London, May 18th*, 1911.)

(*Concluded from page* 990.)

WHEN an exchange is over 1,000, and up to 10,000 lines, a second selector is added. When a capacity of 100,000 lines is required, a third selector is used, and so on.

We will recapitulate the operation of a 1,000-line equipment. On an exchange of this size there will be 1,000 line switches (*i.e.*, one per line), 100 first selectors and 100 connectors. It is found in practice that a 10 per cent. basis is ample for ordinary exchanges; very rarely are there more than 10 connections (or 20 telephones talking) per 100 lines.

After the receiver has been lifted, and before the dial has been revolved to the stop, the line switch has done its work and connected with an idle selector. If the number desired is 865 the caller will place a finger over the number 8 and revolve the dial to the stop. The selector will step up to the eighth level of contacts and come to rest on the first set of contacts if these are disengaged; if, however, that line to a connector is already engaged, the shaft will continue to rotate automatically until an idle connector line is found. The finger will then be placed over the figure 6, and the dial revolved to the stop, when the connector will step up to the sixth level, but will not make contact with any line. The finger will then be placed over the figure 5, and the dial revolved to the stop, when the shaft will rotate until the fifth group of springs on the sixth level is reached.

When stations below 100 in an exchange of 1,000 lines are called the number is proceded by 0, so that the sequence of operations may remain the same, or the two-figure numbers will be omitted.

On 100,000-line systems, instead of using five figures to identify a line, four figures are used, preceded by a letter, as being easier to remember, and generally the letters indicate different exchanges, as the system is usually built up of 10 exchanges, or 10 groups of exchanges, each having a capacity of 10,000 lines.

One level of the bank contacts on a first selector, therefore, will be associated with the local exchange, say, Central, the second with North, the third with South, and so on. The line switch having automatically connected with a first selector, the first movement of the dial will cause that selector to pick up a second selector in one of the groups of 10,000 (this second selector, like the first, may have the first level connected with a local exchange and each of the other levels connected with sub-exchanges, or all the levels may be connected to different groups of 1,000 in the same exchange) and this in turn will pick up a third selector in a group of 1,000, which will pick up a connector and complete the connection as previously described.

It will thus be seen that there is no junction working in the sense of special or more complicated operating such as we usually associate with manual exchanges. The 10 per cent. of lines between selectors may be reckoned as junctions, but the operating is uniform whether they are in the same building or connecting exchanges some miles apart.

It has been found in practice that 10 per cent. of lines between first and second selectors in these large installations is unnecessarily high owing to the rapidity of service, and a "secondary line

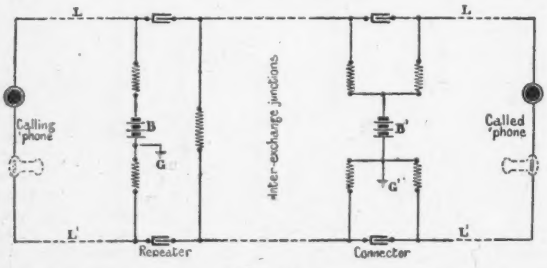

FIG. 7.

switch" has been introduced to reduce that number. Both line switches act automatically and are quite independent of any movement of the dial. This still further reduces the number of lines between exchanges.

To equalise the traffic on the first selectors an intermediate distributing board is introduced between the primary and secondary line switches.

By the introduction of secondary line switches any subscriber's line may use any first selector, and any junction line is made available to any first selector.

Great care has been taken in designing lines between exchanges to balance them, and as will be seen from fig. 7 the simplified circuit is equal to that on any manual system. The circuits are divided for signalling purposes by condensers, and current for the microphones is supplied from a battery in the exchange at each end of the junction as on manual systems. The repeater is for repeating dial impulses only.

The opinion is commonly held that the automatic system is most inflexible, but quite the contrary has proved the case in practice, and all special services, such as metering or registering calls, party line working, private branch exchange working, &c., are now standardised. On a message-rate system the meters are associated with the line switch as already described.

A four-party frequency system is used, with the bells of the subscribers' instruments tuned to respond to frequencies of 16⅔ cycles, 33⅓ cycles, 50 cycles, 66⅔ cycles. A group of party lines will be multipled over four connectors, and to each connector will be supplied ringing current of one frequency only, so that when a connector is brought into use only one particular subscriber on the line can be called.

Private Branch Exchanges may be entirely automatic, but are usually preferred to be manual for local service. A switchboard will have several lines to the central exchange, and these are given one number only. These lines are joined to special connectors which have a feature belonging to the selectors that enables them to continue to rotate automatically until a free or disengaged line is made contact with. The connector is made to rise and rotate to the number of the line in the usual way by rotating the dial twice; then if the first line associated with that number is engaged the shaft will continue to rotate until a free line is obtained, or, if all are engaged, then it will go to the contact beyond, which is associated with that group of lines, and is connected up to give the busy signal, so that the subscriber hearing this knows that all lines are engaged.

Call Offices are operated in a simple but very ingenious manner. The subscriber calls in the usual way, but when the called station answers, the reversed current actuates an electromagnet in the coin box which short-circuits the microphone and places a shunt about the receiver, so that the caller can but faintly hear the party called. On the insertion of the requisite coin the talking is made normal.

As already indicated, a great feature of the automatic system is that it is not essential to concentrate a great number of lines in any one building. The system will work as efficiently if 10,000 lines are in one building as in 10 exchanges of 1,000 lines each. The apparatus, with the exception of, probably, the power plant, will be exactly similar, but the street cable plant will be very different. Instead of 10,000 lines converging to one centre, there will be, in addition to the shorter converging lines, the 10 per cent. of lines between first and second selectors between exchanges. It will thus be seen how efficiently the automatic system meets the varied needs of a great city, where a residential district of a few years ago with few telephones becomes a busy business centre requiring many telephones, like Finsbury Circus; or when a slum, like the district between Holborn and the Strand, gives place to a great thoroughfare like the Kingsway, and thus upsets all calculations of capacity in underground mains and necessitates the reopening of streets. In the automatic system district stations of suitable capacity would be opened in such localities and the necessary local lines concentrated on these, and the existing cables of small capacity to the large exchange would be utilised as junction wires.

A small town with an ultimate capacity of 12,000 to 15,000 lines might be efficiently served by a central of 10,000 lines and several district exchanges varying from 100 to 600 or 800 lines.

In existing manual systems somewhat similar automatic district stations may be used with advantage as valuable adjuncts, either to avoid expensive underground cable work, the provision of new manual plant, or expensive additions to existing plant of limited capacity, and this phase of working deserves more than passing attention. The instruments on such an automatic equipment would be of any of the well-known patterns without any automatic feature whatever. At the district station they would be connected to line switches, such as have already been described, for outgoing work. At the manual exchanges these junction lines would end on the usual line and cut-off relay, answering jack, and calling lamp, or on single-cord equipment like manual incoming junctions. On the removal of the receiver to call, the line switch would connect with a disengaged junction instantly, and the line lamp would glow, and the operator would complete the connection in the usual way, the service being absolutely similar to a connection in a purely manual exchange. For outgoing calls from the manual exchange, an operator would have in addition to the ordinary double-cord equipment, a switch to connect up a dial calling device by which, after making the connection, she would call the number required in a manner similar to a subscriber calling on a full automatic system. All the lines in the district station are multipled on to connector banks to allow of their being called. The above method supposes a complete multiple of the manual exchange to be available.

The manual system is now as near perfection from an operating point of view as it can be brought, and increased efficiency can only be obtained by refinements due to more expert operators and thorough supervision. The principle of working is that the subscriber should only remove the receiver, state his requirements, and replace the receiver on the switch hook, all operating beyond being performed by experts. This sounds good and simple, but it depends, first, on the articulation of the speaker, who may be from any county or any country, and, secondly, on the ear and understanding of the operator to interpret the words before giving effect to them. Again, in a city like London, something like 75 per cent. of the calls are over junction lines, which means that the first operator has to repeat the number required to a second operator. In the automatic system the responsibility for getting any number, no matter how large, is entirely on the caller. If a blunder is made, the caller has only himself to blame. It is also claimed that the subscribers on an automatic system answer more quickly, as there is no operator to blame. For rapidity of service the automatic has the advantage unquestionably. As quickly as a caller can spell out his

number, so quickly is the connection built up, *for any number on the system*, and the clearing is instantaneous. The time taken to send in a clearing signal on the manual is the time taken on the automatic to disconnect. The secrecy of the conversations will also appeal to many.

The capital cost for the actual exchange equipment in small exchanges is much more with automatic than with manual, but as they increase in size they approach nearer until at about 10,000 lines they are equal in cost. This is for single exchange equipment, but when the telephoning of a great city is considered, the results may be very different. The subject is, however, a very complex one, and would require very careful study of a particular area to determine exact costs. This may be noted, however, that whereas the manual system increases with an ever-increasing ratio owing to the increase of junction lines with their complicated circuits, huge multiples and attendant operators, the cost of the automatic system increases much more uniformly. The apparatus increases on the percentage basis, formerly mentioned, and the junction lines are actually fewer, as they carry a greater number of busy-hour calls owing to the rapidity of the service.

Owing to the tendency on the manual systems for junction lines to increase abnormally, as great a number of lines as possible are accommodated in one exchange, and the average length of the subscribers' lines is, therefore, increased. On the automatic system, however, as the working from beginning to end is junction working there is not the same necessity for large exchanges, and the apparatus can, therefore, be broken up and distributed in groups of moderate size as best suits the economical lay-out of an underground cable system. The average length of the subscribers' lines will be, therefore, much less.

Mr. W. Lee Campbell (in his paper before the American Institute of Electrical Engineers, June 29th, 1908) showed by a series of curves the comparative costs of manual and automatic equipments. Since that time the manual system has increased in cost by the introduction of new features.

In the automatic equipment the introduction of secondary line switches has greatly reduced the cost of automatic plant, and particularly the number of underground junction lines to carry the traffic between exchanges.

The following schedules of comparative costs for manual and automatic exchanges of 5,000 and 10,000 lines are taken from the paper referred to.

COMPARATIVE COSTS—MANUAL AND AUTOMATIC SYSTEMS.

	5,000 lines.		10,000 lines.	
	Manual.	Automatic.	Manual.	Automatic.
Value per line—switchboard equipment without junctions	£3/11/6	£4/3/0	£5	£5
Subscriber's instrument ...	£1/15/0	£2/5/0	£1/15/0	£2/5/0
Cubic feet of building ...	42,000	21,000	88,000	44,000
Square feet floor space ...	3,700	2,100	7,250	3,750
First cost fireproof building (Land, furnishings, offices not included)	£1,667	£855	£3,500	£1,750
Operating, repairs, maintenance, per line per annum	£1/5/0	8/10	£1/13/6	9/4
Above plus power, light, taxes, depreciation equipment and building renewals (depreciation of manual taken at 10 years; automatic at 12 years)	£2/1/0	£1/4/0	£2/10/0	£1/5/6

The increased cost of automatic equipment is more than counterbalanced by the reduction in cost of building, the cubic space necessary being only half of that required for a manual equipment.

The manual system is seen at its worst when sub-division takes place. The automatic equipment will not be increased seriously. With the automatic the efficiency will remain the same as if concentrated in one building, whilst in the manual the service will be appreciably slower, and the liability to wrong connection much greater owing to the repetition of numbers, &c.

The cost of buildings is very much less on an automatic system as the equipment is much more compact—no kitchen, rest-room, and other conveniences for operators are necessary. The furnishings, decorations, and electric light fittings are much simpler.

All operators' expenses are saved except such as are required for trunk service, information desks, and the like. Against this has to be placed the cost of electricians or mechanics. One good man is usually provided for every 1,000 lines. Many of the sub-exchanges have no regular attendant, all lines being tested from the nearest main office; the charging of accumulators is effected over wires from the main exchange, periodical visits only being paid to see that all is in order.

The Automatic Electric Co. have lately published a certificate over the signature of the president of the Citizens' Telephone Co., Grand Rapids, that the cost of replacing parts, due to defective workmanship or material, or ordinary wear and tear, during seven years, amounted to $962·62, an average of $137·52 per annum, or 1·8 cents per line per annum, for the average of 7,500 lines in service. This sum included all central equipment, except power plant, and also the dial switches in the telephones.

From figures obtained in connection with the Chicago manual system, the average cost of repairs on central equipments and instruments is about 27s. per line per annum, the cost of repairs on exchange equipment alone averaging about 17s.; the figures ranged between $1 and $10, depending whether the lines were quiet or busy ones. For Seattle the figures are given as 10s. per line per annum, line and exchange equipment, and 10s. per subscriber's instrument.

Semi-automatic systems have been suggested as meeting the requirements of future development, but it is very doubtful if they can be made an economical success. Semi-automatics seem to me to be good only as a transitional measure. The "Traffic Distributor" system of the Automatic Electric Co. meets the requirements in an efficient manner.

DISCUSSION.

MR. J. E. KINGSBURY suggested the necessity for a more definite nomenclature as regards so-called manual and automatic telephones. The C.B. manual board might be called "machine switching," and what the author called the "automatic" would be "machine switching and calling." He did not think the time had arrived when a close comparison of the merits of the present telephone systems and the full automatic could be made. The author favoured the latter, but until there was more actual experience and data on which to form an opinion, it would be premature to decide one way or the other.

MR. FRANK GILL said the National Telephone Co. realised the importance of the private branch exchange operator, and that automatic apparatus could not displace such operator. It was better to put the control into the hands of operators whose time was less expensive than the use of apparatus would be. The author's 22½ calls per junction in a busy hour did not apply in London, where the conversations were much longer. Another erroneous figure mentioned in connection with maintenance was one man per 1,000 lines; he found, when in the States, that it appeared to be one man per 8-hour shift per 1,000 lines; or, say, three men, and the only definite figure would be obtained from the pay roll. It was not a question of manual *versus* automatic, but of where to use an automatic system, and a conclusion could only be come to by studying a complete scheme over a good-sized area, taking into consideration the service to be offered.

MR. WHALLEY said there was sufficient evidence in the paper to show the importance of the subject to the business man; the existing development could not be dismissed. The system was claimed to save time, and in London each second of time was worth hundreds of pounds; the time saving was in the instantaneous disconnection, which the speaker compared to the manual system where, in a place like London, promptitude depended on the operators of at least two, and possibly more, exchanges, being able to attend instantly. They knew that the New York telephone service, with identically the same apparatus, was much more rapid than the London service. The whole matter rested with the business community, and if a saving was worth having, it was worth giving time to study an exchange at work or, if necessary, having a trial installation over here.

MR. M. S. CONNOR said the automatic system consisted of doing certain things automatically and others manually; one only had to compare the making of connections by machines and by hand. He felt, contrary to the usual opinion, that the automatic system was a successful one for giving a service; the subscribers liked it, and it was quick. One was, therefore, left with financial considerations. The expense of operators was less—only one-quarter or one-fifth of the total—and it appeared that this was more than made up by increased maintenance and depreciation charges. The maintenance of subscribers' instruments was the same in each case. He had had personal evidence of the defective working of some automatic exchanges in America, and could not accept the author's figure for maintenance. The capital value per station would also increase each year. Up to the present no automatic or machine system had been devised which could give reliable service at the same cost as a good manual system. The paper gave the common-battery board a life of 10 years; he knew of some that had been in use 15 years, and he thought it quite possible that, with the exception of plugs, cords, &c., a multiple switchboard could be obtained which would last 25 years. The life of the automatic system was not known; it had undergone considerable modification in the last 14 years, and if the number of parts could be reduced and the remainder made more robust there might be some hope for the system. The semi-automatic system seemed to have the disadvantages of both systems and the advantages of neither.

MR. R. SCRUBY referred to experience with automatic telephone exchanges in the U.S.A. and Mexico, which had been installed by the Automatic Electric Co. Where both systems were installed, the public favoured the automatic system, and in some cases all extensions had been made on that system. Automatic telephone development was largely a matter of manufacturing; at present there was not scope for reducing the price. A cosmopolitan calling system was an advantage, particularly to a foreigner who could not speak the language well.

MR. AITKEN, in briefly replying, said the operator in the branch exchange remained with automatic working, and this made the operators appear numerous.

Electrically-Baked Bread. — "Every Sunday the General Electric Co., at Pittsfield, Mass., makes a free distribution of several hundred loaves of bread to the Orphans' Home, day nursery, hospitals and other charities. This donation, highly appreciated by the recipients, is the product of the new electrical ovens being specially developed by the company for the bread baking industry."—*Electrical Record*, U.S.A.

LEGAL.

The British Westinghouse Electric and Manufacturing Co., Ltd., v. The Electrical Co., Ltd.

In the Chancery Division on Saturday, June 17th, Mr. Justice Swinfen Eady gave his considered judgment in the above action. It will be remembered that the case was heard by his Lordship several weeks ago, and was a claim by the British Westinghouse Co. against the Electrical Co. for alleged infringement of their patent rights in regard to flame arc lamps sold by them in the market. Defendants denied infringement and pleaded common knowledge and invalidity of patent.

Mr. Justice Swinfen Eady said the validity of this patent had come in question in a former action between the plaintiffs and one George Braulik, when the patent was upheld by the Court of Appeal (27, Reports of Patent Cases, page 209). But the evidence in the present case was different, and the alleged infringement was a different lamp. The patentee stated in the specification that his invention related to electric arc lamps of the kind or class in which the electrodes were inclined to each other, and both pointed in the downward direction, the arc being formed at their lower extremities; and he claimed as his invention "an arc lamp, having downwardly pointing electrodes, and provided with both downward and horizontal feed mechanism, so arranged that a certain amount of operation of the horizontal feed mechanism takes place, before the downward feed mechanism is permitted to operate, subject to the disclaiming note." The disclaiming note was as follows: "The lamps to which this my invention applies are of the type in which the current is supplied to the electrodes through electrode holders in which the upper ends of the electrodes are firmly clipped, and which are capable of being lowered simultaneously through the same distance and about one of which the corresponding electrode can swing under the action of a device acting near its lower end, and I limit my claim to lamps of this description." It was determined, in the former action, that there was no substance in the objection as to insufficiency of specification; that the letterpress was clear and intelligible, and, when taken in connection with the figures, rendered it perfectly easy to understand the invention. He was bound by the construction put upon the specification by the Court of Appeal in the former action. It was urged, however, that the language of the plea of insufficiency was different in the present case from that in the former, and that if the patentee intended a floating feed, the language of his specification was very inappropriate for that purpose. But this point was covered by the previous decision. The mechanism shown and claimed in the specification was capable of instantaneously adjusting the electrodes so as to compensate for the irregularities in them, and thus keep the light steady. It was then said that there was no evidence of utility in the present case, but the sale of the Excello lamp was proved by Mr. Marshall. This was made substantially in accordance with the plaintiffs' specification, and the manufacturers had already paid royalty on nearly 20,000 lamps to the owners of the patent in question. It was then contended that the plaintiffs' patent failed for want of novelty, that the invention had been anticipated, or at all events, having regard to common knowledge, there was no subject matter. With regard to Graham's lamp, he was satisfied that he did not contemplate, or intend, or describe, any arrangement intended to obtain a floating feed. The essence of his invention was his device for regulating the escapement by an electromagnet. The patentee's mode of regulating the length of the arc was by regulating the downward feed, and not by obtaining any horizontal floating action. Although a model of Graham could be made so that it would float, there was, in his opinion, no indication of obtaining a floating feed in Graham's specification from beginning to end. Crosby was much further off floating than Graham. Wright's patent was for a magazine electric arc lamp, the object being to provide a lamp with a series of carbons arranged in magazines and also having a central main for automatically feeding the carbons one after the other as they were consumed. A model of this was produced, but it was a model of a magazine lamp without the magazine. It seemed quite a hopeless lamp. With regard to floating, the extreme positions of the electromagnetic mechanism would vary in accordance with the number of carbons in the magazine, and the points of equilibrium would vary also. If the lamp did float, the feed would become hopeless, because one carbon would go before the other, and the only way to make the lamp work would be to arrange it so that there was no floating in the ordinary working and that when it did feed it fed both carbons. Jamin was also referred to, but it seemed to have very little, if any, bearing on this case. The real contention of the defendants was that the substance of the plaintiffs' patent was to be found in Graham, Crosby and Wright taken together, and adding common knowledge. In his opinion, that contention could not be supported. The plaintiffs' invention was for a lamp of a certain definite type, and was a distinct advance upon everything that had gone before; it had enabled flame arc lamps to come into general and commercial use; it had given to a definite type of lamp a floating horizontal feed in a definite manner, and superior to anything which had gone before. The invention was new and useful, and subject-matter for a valid patent. The infringement seemed clear. The defendants had in substance taken the plaintiffs' lamp, although with variations; they pivoted the guides, with the result that there was a larger mass to be moved. But it could make no difference in principle whether they merely moved the electrode and its holder, or whether they regarded the whole frame as being the electrode holder, pivoted that, and then operated it as near the bottom as possible. Such a variation was covered by the doctrine of mechanical equivalents. The horizontal floating was obtained by a similar method in each case. The result was that the plaintiffs succeeded, and were entitled to the relief they claimed.

Mr. Walter: I ask your Lordship for an injunction, an inquiry as to damages, and delivery up, and for a certificate of the particulars of breaches. I have the certificate of validity of the Court of Appeal, but the validity has been attacked on fresh grounds here, and I ask for a certificate that the validity of the patent came into question.

Mr. Justice Swinfen Eady: Yes.

Mr. Bousfield: Will your Lordship grant a stay as regards the inquiry and delivery up?

Mr. Justice Swinfen Eady: I never grant a stay of the inquiry as to damages.

Mr. Bousfield: With regard to the delivery up?

Mr. Walter: I shall not raise any objection to a stay of the delivery up if they intend to appeal, say, within a fortnight.

Mr. Justice Swinfen Eady: Then by consent if you serve notice of appeal and set it down within 14 days from to-day, the operation of the order, so far as the delivery up is concerned, will be suspended till after the appeal has been disposed of.

Mr. Bousfield: And the costs on the usual undertaking?

Mr. Justice Swinfen Eady: No; I want evidence for that. There is no stay as to costs.

Metalite, Ltd., v. Edwards.

At the Clerkenwell County Court on Monday last week, before his Honour Judge Edge, a claim was made by the Metalite, Ltd., of Horsell Road, Highbury, N., against George Edwards, of St. George's Picture Palace, Westminster Bridge Road, S.W., for £10 6s. 4d., in respect of goods supplied. Mr. Whitehouse was counsel for defendant.

Mr. Dale, counsel for plaintiffs, said his clients supplied to defendant's order 100 Metalite electric lamps. They were delivered to defendant on January 11th. Soon after plaintiffs' traveller, who took the order, called upon defendant, who made some complaint. The traveller told defendant if he was not satisfied to send the lamps back. He did not do so. Several applications were made for payment, and on April 17th defendant wrote saying there was some mistake about the lamps, and he was sending the whole consignment back. They were sent back nearly four months after the date of delivery, and it was found that 85 out of 91 lamps were smashed.

The evidence called for plaintiffs showed that the lamps were delivered to defendant in four brown paper parcels. There were patent wrappers round each parcel, and they were delivered by hand by a special messenger. They came back in parcels delivered by carriers. It was contended that goods of this sort, if sent by carrier, ought to have been packed in a case or barrel. When returned there was no label on the goods to say that they were fragile.

Defendant, in evidence, said he was proprietor of several picture palaces. He only opened one out of the four parcels. He found some filaments were broken, and two lamps were smashed. Whilst at his place the goods were stored where no injury could come to them. He returned them by carrier, because he was instructed by plaintiffs' traveller to do so.

The Traveller, recalled, admitted that he told defendant to send the goods back by carrier.

Judge Edge: Did you say anything as to how the lamps should be packed?—I told him he had better send them back in the same parcels in which they came.

You gave no warning that they should be sent back in boxes?—No.

His Honour said that upon examining some of the goods and finding them defective, defendant was justified in refusing to pay for them. He undoubtedly rejected the goods, and his duty was to have returned them at once. Defendant stored the goods, and plaintiffs allowed him to store them. He (the Judge) had no doubt that when the goods were delivered 90 per cent. of the lamps were good; and he had no doubt that the damage occurred in sending them back, but they were sent back according to the instructions of plaintiffs' agent. The verdict must be for defendant, but without costs.

National Telephone Co., Ltd., v. Postmaster-General.

When the hearing of this case was resumed last week, Sir A. Cripps, K.C., on behalf of the National Telephone Co., contended that if a piece of plant was suitable for the requirements of the Post Office on December 31st, 1911, it did not become unsuitable merely on the ground of redundancy. If the test of the Post Office requirements was what plant was required on that day both services would be working on that day, and it could not be said that plant which was actually in use was not required.

With regard to the notices, the Postmaster-General had obtained for himself the advantage that he could give notice of objection. That, however, did not enable him to put on the company the burden, which might be serious, of finding out what was included in the notice. It was for the Postmaster-General, who gave the notice, to make plain what he was objecting to. It was no answer to say that the matters were so complicated that it would be impossible for the Postmaster-General to do this, for the more complicated the matter was the more necessary was it that the notice should be such that a reasonable man of business could act upon it. If it was impossible to give such a notice, then it was impossible to give

a valid notice at all. In concluding his address, the learned Counsel agreed that the notices given by the Postmaster-General under Part I of the agreement were sufficiently specific, but that the other notices which the Postmaster-General had given under Parts II and III of the agreement were not sufficiently specific, and that the decision of the majority of the Commissioners upon that part of the case was right.

On Tuesday, June 20th, the ATTORNEY-GENERAL having concluded his reply on behalf of the Postmaster-General, their Lordships reserved judgment until Wednesday, June 28th.

COLLIERY OFFICIALS PROSECUTED.

JOHN BURGESS KILPATRICK, manager of Ross Colliery, Hamilton, Andrew Thomson and William Somerville, under manager and overman respectively at that colliery, were charged at Hamilton Sheriff Court on Wednesday last week, with contravening the Coal Mines' Regulations Act. The manager and overman were charged with having failed (1) to provide sufficient manholes for places of refuge in a haulage road in No. 1 pit; (2) to see that certain of the manholes were kept constantly clear; and (3) to see that two travelling roads in the main coal seam were of sufficient dimensions. The manager was further charged with failing to have the electrical apparatus sufficiently earthed, while the charge against the under manager was confined to the first part of the complaint against the manager. After part of the evidence against Kilpatrick had been led, he admitted the charge as libelled. Sheriff Shennan fined the manager £3, Thomson, who also pleaded guilty, was admonished, while Somerville was convicted on evidence, and fined 30s.

ELECTRIC GALVANISING PLANT DISPUTE.

IN the Official Referee's Court, before Mr. Muir Mackenzie, the Northern Flexible Metallic Tube Co., 39, Gratton Road, Bradford, were defendants in an action brought by Messrs. W. Canning & Co., of Birmingham, to recover the balance of the price of electric plant for galvanising iron strip. Defendants alleged that the plant was defective in many respects and counterclaimed for damages.

MR. TERRELL, K.C. said that the question to be decided was whether the plant supplied was efficient for its purpose. Plaintiffs contended that it was, and that if any defects did arise they were caused by want of skill on the part of defendants' employés. Counsel explained that flexible tubing was produced by a process of coiling long iron strips or ribbons, a thin strip of rubber fashioning the joints. It was necessary to protect the tubing, when made, from the ravages of rust, and this was done by giving it a thin coating of zinc. In 1908, the defendant company were desirous of procuring a galvanising plant for the purpose of galvanising their own strip, which hitherto they had not done. The plaintiffs agreed to supply a plant which was the subject matter of the present action. The strips of steel wire passed through a tank containing a carefully prepared solution. An electric current was passed from the anode in the tank through the solution to the steel strip which formed the cathode and deposited on the strip a coating of zinc. The electrical energy was supplied by a dynamo, and the current used had to be carefully regulated. After plaintiffs had put down the plant in 1909, at a cost of £260, it was tested on February 21st, and described by the defendants as very "satisfactory." In April they wrote still saying it was satisfactory, but complaining that the zinc coating obtained was too dark, and asked plaintiffs' advice. Plaintiffs wrote, asking for samples of the solution, &c., defendants were using, but did not get them. Hearing no more they rendered their final bill, but defendants refused to pay, contending that the plant was not satisfactory.

MR. GEORGE AUDRIED DARBY, an electrician in the plaintiffs' employ, gave evidence as to visiting Bradford to test the plant after it had been put down. Such plant, he said, needed very careful watching to see that the electric current used was kept quite steady. He ran the plant, passing some 252 lb. of steel strip through it. It did the work of galvanising very well, and defendants' representative expressed himself as quite satisfied with it. When he went down at a later stage after the dispute had arisen over the settlement of the account, he found the plant in a very dirty and rusty condition. Changes had been made in the working of the plant which seemed to suggest that defendants had been trying to experiment with it. If the plant were properly cleaned and put into working order, with skilled men to attend to it, it would turn out perfectly galvanised steel strips.

Cross-examined by MR. WAUGH, K.C., for the defendants, WITNESS admitted that he had not worked a plant similar to the one in question anywhere else. He was testing it for four and a-half days.

WITNESS admitted that it was necessary for the sawdust through which the steel strip passed for the purpose of drying, to be moved about to prevent that nearest the strip from becoming sodden. There was no mechanical device to do this on the plant in question.

Questioned with regard to the suitability of the electrolyte, WITNESS said the use of the hydrometer was not sufficient to test whether the solution had been made up properly. Witness denied that ever since the plant had been put in trouble was caused by the fact that the machine did not properly cleanse the strip of acid and alkali.

Re-examined, WITNESS said it was quite a simple matter for the man attending the machine to keep the sawdust dry by hand. The electrolyte was made by dissolving zinc in caustic soda, and it was very necessary that the electric current should be properly suited to the density, &c., of the electrolyte. The steel tape passed into a pickling bath containing a solution of hydrochloric acid, and then through a pair of felt wipers into the depositing tank. If these wipers were in proper condition, no acid should escape through on the tape. When he was testing the plant, he found that the best current density for galvanising the tape was 120 amperes.

MR. H. RILEY, another electrician in plaintiffs' employ, said he helped last witness to test the plant in question.

MR. WILLIAM STEPNEY RAWSON, consulting electrical engineer, said he had examined the plant, and was of opinion that with proper supervision it ought to work satisfactorily. He did not think that the zincing would take on a dark colour in the electrolytic tank.

MR. TERRILL: Have you ever seen the zincing come out porous?—Yes, when the current has been excessive.—WITNESS said there was a switchboard and a resistance, and from the switchboard the operator could from time to time regulate the strength of current sent through the electrolyte.

Cross-examined, WITNESS said given reasonable supervision, a two hours' test was sufficient to see whether the electrical portion of the plant would work properly. He denied that the strip would show a black appearance in the electrolytic bath unless the current density was reduced to a very small minimum indeed. With the exception of rust on the original strip, it would not become dark by reason of inefficient cleaning in the process through which it passed. If the speed at which the steel tape passed through the plant were increased it would be reasonable to increase the electric current density in order to maintain a uniform zinc coating on the strip.

MR. WAUGH: Did you notice that the swill boxes were lined with zinc?—I did not.

You agree that the effect of hydrochloric acid on zinc would be to dissolve the zinc at once.—Yes.

Would it be a proper method to line boxes where hydrochloric acid is washed off the steel tape with zinc?—No.

If the current is maintained at a proper average, could you account for the strip coming out dark in places and subsequently rusting?—No, that puzzles me.

Assuming that the swellers were not properly acting, and the felt pressers did not take away all the caustic solution or acid, might not that cause part of the strip to be darker in colour than others?—It is difficult to say.

In order to get proper galvanising it is essential that the strip when it goes into the galvanising tank should be quite free from previous processes?—Yes.

MR. GEORGE ARTHUR POPE, works manager in the electrical and engineering department of the plaintiff company, stated that he was associated with the design of the apparatus in question. The general principle of the design could not be followed in the case of defendants' plant because of want of space.

MR. WM. EARL HUGHES, examiner in electrometallurgy to the City and Guilds of London Institute, gave evidence from an electrochemical point of view. Plaintiffs, he said, gave him samples of steel strip galvanised, and not galvanised, for testing. Witness had been asked to find out what would be the quickest time and lowest current used in which to produce a deposit similar to that on the galvanised sample sent to him. With the aid of Sir Wm. Preece's process he had found that by using one-tenth of an ampere on a 1 ft. length of ¼ in. strip for a period of 10 or 15 minutes, he obtained the deposit of zinc desired. He examined the plant in question on February 8th, 1911, at Bradford. It was in a filthy condition. He thought that if the plant had been properly worked under efficient supervision the results would have been satisfactory.

In cross-examination, WITNESS said, from what he saw, the dynamo was quite sufficient for the purpose, the electrolyte was satisfactory, and the pickling tank and swills were suitable. Too much or too little electric current would make the zinc deposit on the steel tape darker.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Unbreakable Insulators.

THE "NEVERBREAK" INSULATOR CO., of 26, Parliament Hill, Hampstead, N.W., have introduced an insulator made of a special composition of great toughness, for use on telegraph and telephone lines; it is claimed that the new insulators are bullet-proof and unbreakable, and thus obviate the loss and inconvenience due to the breakage of porcelain insulators and the consequent interruption of the line.

The material of which the insulators are made is weather-proof and almost indestructible, and the screw threads are accurately cut, so that they are easily fitted to the supports, without the use of cement. The insulation resistance of the insulators, as tested in water at Faraday House, was over half-a-million megohms (that being the limit of sensibility of the instruments employed); after seven days' immersion in brine, the insulation resistance was about 100,000 megohms, and on applying an alternating pressure at 50 cycles per second the insulation was not broken down until pressures exceeding 13,000 volts were attained. Tested by the Reichsanstalt, the insulation resistance of the smallest insulator was about two million megohms. Fired at with a shot gun,

the insulators show merely superficial injuries, in no way affecting their efficiency as insulators, and their dark brown colour also aids in protecting them from damage. We understand that insulators of this material have been in use abroad, in hot climates and on the sea coast, for years and have given satisfaction.

Fireproof Insulated Lampholder.

Messrs. Falk, Stadelmann & Co., Ltd., of Efesca Electrical Works, Farringdon Road, E.C., have put on the market a new design of fireproof and insulated lampholder. Its salient points

Fig. 1.—Efesca Insulated Lampholder.

are compactness and neat design, and it is made to comply with the Home Office Regulations applying to fireproof and shockproof fittings. The holder, which has no metal casing, is illustrated in fig. 1; the insulating cup completely covers the metal cap of the lamp.

Mechanical Electric Current Gauge.

A clever and interesting device has just been brought out by Messrs. Drake & Gorham, Ltd., of 66, Victoria Street, S.W., for ascertaining to a fair degree of approximation the current flowing in a conductor without severing the latter or interfering with it in any way. The mode of indication is novel and ingenious. The accompanying illustrations, fig. 2, show the construction of the instrument, which partakes of the nature of a pair of tongs; a U-shaped bend of laminated iron A is fixed to a prolongation of the handle H, and a lever carrying an iron armature B is pivoted between centres J carried by the latter, approaching the iron bend at one end, and carrying a flat spring D at the other. A screw E bears against the spring, and is turned by a milled head F provided with a pointer P, which moves over a dial S. In use, the instrument is applied to the cable, fuse, or other conductor, so that the latter lies anywhere in the bend, magnetising the iron, and attracting

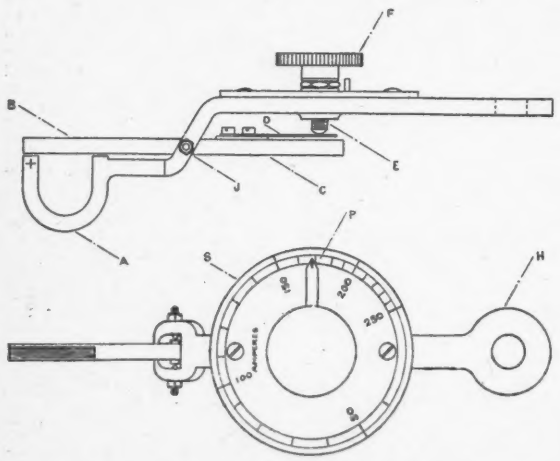

Fig. 2.—Frisby's Patent Current Gauge.

the armature against the poles, the pointer having first been set to the zero position. The screw is now slowly turned until the armature springs away from the poles, when the current strength is indicated by the position of the pointer on the scale, which is divided from 20 to 250 amperes.

The instrument is of extremely simple and strong construction, and should prove of great utility in various applications; for instance, the currents flowing in the several cables connected to the bus-bars in a feeder pillar can quickly be gauged, and similarly the currents in the cables in a street manhole, on a switchboard, &c., can be ascertained.

A current detector based on a similar principle is also made, which indicates the direction as well as the presence of a current in a cable; in this case the bend is a steel permanent magnet, which is applied to the conductor first in one way, then in the reverse position, the increased attraction of the magnet upon an armature in one or other position indicating the direction of the current, and the absence of increased attraction in either direction showing that no current is flowing. Both instruments are unaffected by the currents in neighbouring conductors.

New Sign.

Messrs. Venner & Co., of 6, Old Queen Street, Westminster, have just brought out a new sign which has the advantage of presenting a striking appearance by day as well as by night. In this device the outlines of the letters, &c., are marked out with glass balls, provided with a suitable backing, which in daylight look like luminous rubies; a similar effect is obtained at night by illuminating the front of the sign with an electric lamp. For those who wish for an effective but very inexpensive sign, this should prove admirably adapted.

Electric Furnace Transformer.

The accompanying illustration (fig. 3) shows a special type of transformer which is made by the Foster Engineering Co., Ltd., of Morden Road, Wimbledon, S.W.; it has been supplied to various makers of incandescent electric lamps for furnace working. The normal output of the transformer here shown is 12 kw., but this can be increased for short periods to 20 kw. without injury. The primary is designed for 300 volts at 50 cycles, and the secondary gives 2,000 amperes at 6 to 8 volts; the secondary

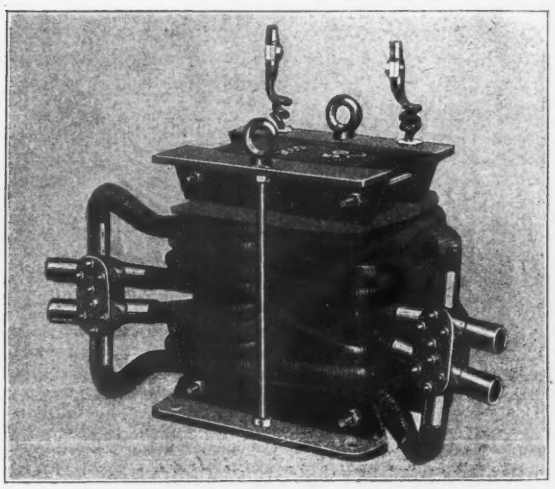

Fig. 3.—Foster Furnace Transformer.

winding consists of finely stranded cable, each wire being insulated from its neighbour, to prevent heating due to eddy currents in the large conductor required by the heavy current, and it is divided into four sections, connected two in parallel. The efficiency of the transformer is from 97 to 98·5 per cent. according to the load, and the temperature rise is the same as in ordinary types. The secondary terminals are large sweating sockets, which are bolted to the furnace leads.

The Electric Smelting of Iron. — According to a statement attributed to the Aktiebolaget Elektrometall, of Ludvika, the cost of producing electric pig-iron at Swedish hydroelectric works, where the annual cost per kilowatt ranges from £1 18s. 8d. to £2 15s. 2d., is from 5s. 6d. to 11s. per ton cheaper than pig-iron made in the blast furnace. At the end of this year there will be four electric furnaces of the Elektrometall type in operation in three different places in Sweden of a total capacity of 12,500 h.p., and an output of 35,000 tons of pig-iron per annum. Several undertakings have also been formed in Norway for the electrical production of iron and steel, and a resuscitation of this industry is expected in that country. The Hardanger Elektriske Staalverk is erecting two furnaces, each of 2,900 h.p., and a steel furnace of 800 h.p.; and similar and larger installations are being established by the Tinfors Jernoers Aktiecelskab, the Stavanger Staalverk and the Arendals Fosse Co. The production of electric steel is also said to have good prospects in store. If the pig-iron made first in the electric furnace is placed in a gas-heated mixer, and then refined in the electric steel furnace, the product is declared not to be inferior to the best open-hearth steel. The Association of Ironworks in Sweden, and a Government Commission in Norway, are occupied with the testing and improvement of electric smelting processes, but it is considered already beyond doubt that the electrical methods have a great future before them.

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Sag of Line Wires.

Your correspondent, Mr. J. B. Sparks, in a recent issue suggested a means of determining the sag of a wire which was quite incorrect, and in your issue of the 16th inst., in his endeavour to improve matters, he attempts to incriminate Mr. Trotter. His method is incorrect and his calculation insufficient because he assumes the wire to be inelastic. If a wire is dropped, as he suggests, the sag will be much more than doubled. In fact, the relationship between the sags corresponding to the single and double spans, is a ready means of determining the elasticity of the wire (see *Proceedings* I.E.E., 1910, page 817).

W. B. Woodhouse.

Thornhill, *June 19th*, 1911.

Electricity Libelled Again.

I beg to draw your attention to the two following extracts from the *Birmingham Daily Mail* for Friday and Saturday last with reference to a fire which occurred at the West Bromwich Town Hall:—

Fire at West Bromwich Town Hall.

Shortly after midnight the West Bromwich Fire Brigade was called to the Town Hall, where it was found that the electric wires in the meter house, which is situated beneath the organ, had fused and burnt through the wood casing. The outbreak was discovered before it had got any hold, or the damage would have been serious. The brigade under the command of Captain Tozer turned out, and in a very short time had extinguished the flames.

Fire at the West Bromwich Town Hall.

Mr. W. A. Jackson, the West Bromwich electrical engineer, informs us that the fire which occurred at the West Bromwich Town Hall on Thursday night was not, as stated, due to the fusing of electric wires, but to an escape of gas. It seems when the illuminations in front of the hall were extinguished, the pressure of gas was so great that it caused an escape in the meter house, which was followed by an explosion and the burning of the casing of the electric wires, but the outbreak was fortunately quickly discovered and the flames extinguished.

This is another sample of journalistic enterprise: the reporter is informed that the casing conveying the electrical conductors is scorched, and he immediately jumps to the conclusion that the fire had an electrical origin.

I may say that the meter house accommodates both the gas and electric meters, a large governor being placed on the gas pipe, and a small gas jet is always burning. It was found, when the gas illuminations were burning, that the pressure was insufficient, and it was, therefore, increased. When the gas was instantaneously extinguished, there was a sudden rise of pressure on the main, causing a leakage of gas at the governor; the small meter house quickly became charged with gas, which, being ignited by the small gas jet, caused an explosion. The escaping gas from the governor became a flame which scorched the wood casing situate above it.

Fortunately, the fire was quickly discovered, or a serious conflagration would have occurred, the cause of which would certainly have been ascribed to fusion of electric wires, which canard it would be impossible to refute, as all trace of its origin would be quickly destroyed.

W. A. Jackson.

Electricity Works, West Bromwich,
June 26th, 1911.

Bremer Arc Lamp Patent.

With reference to the advertisement of the British Westinghouse Electric and Manufacturing Co., Ltd., which appeared in your issue of 23rd inst., page 22, and is liable to create the impression that all flame lamps are to be manufactured under the Bremer patent, we wish to point out that such is not the case.

For our "Flamgold" lamp we hold a licence from the British Westinghouse Co. under the Bremer patent.

Our "Angold" magazine flame lamps and our "Butt" flame lamps are, however, completely outside the claims of the patent in question.

The General Electric Co., Ltd.

London, E.C., *June 26th*, 1911.

BUSINESS NOTES.

Consular Notes.—Brazil.—The British Consul at Bahia reports that the supply of catalogues and price lists to the Consulate is of no practical use. Most of those forwarded are in English, a few in Spanish. It should be clearly understood that the language of Brazil is not Spanish but Portuguese, and that the Brazilian objects to being confused with the other inhabitants of South America. The employment of commercial travellers is more than ever necessary in the market, and in cases in which members of firms take the trouble to visit clients they are very successful in obtaining orders. Local buyers have got more and more into the habit of buying direct from European markets, and as a result the British firms which formerly acted as middlemen are becoming fewer yearly. In Bahia their number is less than a fourth of what it was 20 years ago.

Norway.—The British Consul at Christiania reports that several works for the electric smelting of iron ore and one for the electric production of steel from broken-up vessels, &c., have been either under construction or planned in 1910. Of other developments must be mentioned the Electric Ore Smelting Co., in Tyssedal, near Odda, on the Hardangerfjord; the preliminary works have been commenced, and the concern is calculated to be in working order about the spring of 1912. Besides the electric smelting of iron ore which it intends to begin with 2,500 H.P., the company will also erect a station for the smelting of zinc ore, for which 3,000 to 4,000 H.P. will be used. The electric steel industry has been started by the Tinfos Papirfabrik, of Notodden, which possesses, besides its two wood pulp mills and an electrical power plant for 8,500 H.P., together with a saw and planing mill, electric smelting works for the smelting of iron ore. By way of experiment the company started in January, 1910, with 500 H.P. During the year it has produced about 450 tons of pig-iron. A separate limited company has now been formed under the name "Tinfos Gernverk" with a capital of 1,000,000 kroner. This company is going to continue the above-mentioned smelting works, which are the first of the kind in Norway. It is intended during 1911 to build and start smelting furnaces for 5,000 H.P., which are expected to be in full swing in the course of the summer. During 1912, when the next 5,000 H.P. will be available, the smelting furnaces will be increased, and the rolling mill and steel works will be erected. Another 5,000 H.P. may eventually be added. The ore is brought from the Lango, near Kragero. It contains on an average 48 per cent., and is of an excellent quality, lending itself particularly well to improvement into the finer kinds of steel. At the Ulefos Jernwerk the owner, Mr. D. Cappelen, has an electrical furnace for iron smelting, and the accessories for a second furnace have been ordered. In a few months this second furnace will also be started. As soon as the necessary experience has been gained, it is intended further to develop this plant by utilising the considerable water-power which will soon be available at the Ulefos Jernwerk. The water-power of the Eedsfos and Vrangfos (two waterfalls), which also belong to Mr. Cappelen, is to be kept in reserve for future expansion. The Fehu mines, near Ulefos, belonging to Mr. D. Cappelen, have produced about 20,000 tons of iron during the year, employing 125 men. Near the latter mines are the Vibeto iron ore fields, in Hollen, near Ulefos by Skien. These mines are alleged to contain hematite iron of excellent quality, but their quantity of ore has not yet been ascertained. A great number of large and small iron mines exist in the district of Arendal, yielding ore of excellent quality, and a new company, under the name of Arendals Fossekompagni, has been started by Mr. S. Edge, with a capital of about 4,000,000 kroner, for the manufacture of electric iron and steel. Near Arendal there is also a factory, called Electrum Metalurgisk, for making ferro-silicon. The Morgenbladet reports that about 100 tons of steel of excellent quality were electrically produced in a 1,000-H.P. furnace by the Alb Hiorth process at Jossingfjord, between Flekkefjord and Egersund. About 800 tons of aluminium were produced in 1910 at Vigeland's Works, near Christiansund, where imported aluminium oxide is reduced by electricity. The Norwegian export of ferro-silicon was about 5,000 tons. The Sundlokken electro-thermic zinc factory, near Hafslund, produced about 4,000 tons of electrically refined zinc, the raw material being partly foreign raw zinc and partly ore imported chiefly from Australia and Greece. The total export of calcium carbide was only about 50,000 tons, manufacture being reduced owing to over-production abroad, while the export of cyanamide was some 4,500 tons. The value of the above-mentioned products together is roughly estimated at about £650,000.

India Tired of German Machinery.—A contemporary quotes the following from *Eastern Engineering*:—"Germany has always looked upon India as the country above all others in which every sort of concession in price and everything else should be made in order to strengthen her position. The length to which this is carried was clearly instanced by the recent Allahabad Exhibition, where the German section was practically run at the expense of a philanthropic syndicate, which enabled German manufacturers to exhibit at practically no cost to themselves. But it would seem that in India, as in many other countries, the local user of machinery is not to be tempted by all these inducements to purchase inferior plant. Steam engines were purchased to the value of £547,232, of which the British share was £519,267 and Germany's only £7,558. In mining plant to the value of £49,108 Great Britain furnished £32,098 and the United States practically the whole of the remainder. Germany supplied none. In textile machinery to the value of £1,434,369 the British share was £1,418,903 and Germany's £6,494. In miscellaneous machinery to

the value of £1,127,680 the British share was £1,006,682 and Germany's £32,457. Even in electrical machinery, on which Germany prides herself very highly, her trade with India in the year under review reached only the modest figure of £1,805. In railway carriages and trucks, out of a total value of £1,532,271 the British share was £1,523,086 and the German share £642. In locomotives, out of a total of £585,425 the British share was £580,396 and the German share £851. In rails and fishplates, out of a total of £636,446 the British share was £592,413 and the German share nothing. In iron and steel sleepers, out of a total of £124,281 the British share was £120,970 and the German share nothing. It is also interesting to note the following sweeping reductions in Germany's trade with India which have taken place in the last three or four years:—Imports of German cutlery have been reduced by more than 50 per cent., enamelled ironwork by 76 per cent., electrical instruments by 52 per cent., electrical machinery by 70 per cent., steam engines by 63 per cent., scientific instruments by 58 per cent., textile machinery by 68 per cent. and rolling stock by 90 per cent."

An Association for British Manufacturers in Australia.—Mr. P. H. Butler, jun., the honorary secretary (*pro tem*) of the Australian Association of British Manufacturers and their Representatives (Equitable Building, Melbourne), has placed before us a summary of the objects and intentions of the Association, which we have pleasure in bringing under the notice of our readers. We understand that the Association has met with good support in Australia among representatives of British Manufacturers, but, in order that it may be able to successfully perform the work for which it has been established, it will be necessary to have the earnest co-operation of home firms, and it is hoped that this co-operation will be secured. So far the organisation has been conducted from Melbourne, but members have been enrolled in all the other States of the Commonwealth, in each of which it is proposed to arrange for representation and separate committees as soon as the membership warrants doing so. The objects and intentions of this Association are summarised as follows:—

"To promote British export trade.

"To look after the interests of manufacturers and wholesale distributors in the United Kingdom having branches or representatives in Australia.

"To correspond with the Imperial Government through the Colonial Office of the Board of Trade on behalf of the members of the Association, and to perform the same office with the Commonwealth Government, Dominion (N.Z.) Government, States Government, the authorities in the Pacific Islands, and the Municipalities in Australasia.

"To take into consideration—Acts of Imperial and Oversea Parliaments so far as the trade from the United Kingdom to Australia is affected by tariffs, regulations of Commerce Acts, &c.; forms of tenders, specifications and general conditions of Federal, State and Municipal contracts; freights, shipping, wharves, and the discharge of cargo, protection of trade marks and patents; marine insurance, banking, post and telegraph.

"To collect information from official and other channels pertinent to British trade, and distribute it amongst members of the Association, and to receive applications for agents from firms at home and put them before members.

"To receive and sift complaints, of whatever nature, the circulation of which is calculated to be harmful to British trade interests as a whole, and to induce residents of British possessions to purchase goods made in the United Kingdom in preference to foreign-made goods; and generally to take in hand any matters which are considered likely to benefit the trade of British manufacturers and their representatives."

The subscriptions have been fixed as follows:—British manufacturers, £2 2s. per annum; representatives of British manufacturers, £1 1s. per annum.

The Association was formed at the instance of a number of British manufacturers having branches in Australia and representatives of British manufacturers who were conscious of a long-felt want of an organisation to assist them in their trade in many ways. It is believed that in this Association British manufacturers and their representatives will have a powerful organisation through which they will always be able to bring far greater weight to bear concerning any matters which they may, at any time, find blocking or hindering their trade, than could possibly be exercised by any one individual, and, at the same time, an organisation through which they will be able to obtain any information which they may from time to time require.

Liquidations.—The British Tungsten Lamp Co., Ltd.—The statement of affairs shows that as regards creditors the estimated amount available to meet the claims of debenture-holders is £11,175, and the estimated deficiency of assets to meet liabilities of the company, subject to cost of liquidation, is £14,744. The total deficiency as regards contributories is £28,747. The Official Receiver, Mr. E. D. Symond, of Liverpool, in his statement of affairs reports as follows:—"The company was incorporated on December 1st, 1908, with the object of executing an agreement with the Metallfadenlampenwerk, Berlin, and the Syndicate Lamp Co., Ltd., for the purchase of the British and Colonial rights in the metal filament and metal-filament lamp and the patents attached thereto, belonging to the Metallfadenlampenwerk, Berlin, and in which the Syndicate Lamp Co., Ltd., had an interest. The total consideration to be paid by the company was £9,000, of which £7,000 was to be in fully paid shares and the balance in debentures. The company also undertook to pay liabilities amounting to £700. No prospectus or circular was issued to the public, inviting subscriptions for shares or debentures in the company. The nominal capital of the company was originally £12,000, divided into 12,000 shares of £1 each, but by a special resolution of the shareholders, passed at an extraordinary meeting held on July 13th, 1909, it was increased to £25,000 by the creation of 13,000 shares of £1 each. This further capital was required for the purposes of acquiring the assets of the Premier Electric Lamp Co., Ltd., under an agreement dated July 12th, 1909, the consideration being the allotment of £15,371 in second debentures, £1,629 in fully-paid shares, and the payment of certain liabilities. The company has made two issues of debentures, the first being on May 18th, 1909, when debentures to the amount of £4,000 were issued. On September 15th, 1909, there was a further issue of £5,000. On November 20th, 1909, a notice of memorandum of satisfaction of debentures to the extent of £2,000 was registered, and on December 9th, 1909, debentures to a further amount of £2,000 were issued. These are all known as first debentures, and cover the whole of the assets of the company, with the exception of uncalled capital. On September 15th, 1909, an issue of second debentures was made amounting to £15,370. A Receiver was appointed by the debenture-holders on August 6th, 1910, and he states that the assets of the company have been sold, but that he doubts if there will be any surplus for the holders of the second debentures. With reference to the trading, the profit and loss account on September 30th, 1909, showed a loss of £2,550, and a similar account on August 6th, 1910, showed the total loss at that date to be £2,767. The directors of the company at the date of the winding-up order were Messrs. T. L. Cunningham, Balfour House, London; T. Griffiths, Didsbury; C. E. Maples, Liverpool; R. O'Bryen, London; and N. R. Stirling, Bootle. With the exception of Mr. Cunningham, they were all appointed under the agreement with the Premier Electric Lamp Co., Ltd. The cause of failure is attributed by Mr. T. Griffiths, one of the directors, and Mr. J. Peace, the secretary, to the following causes: "Heavy initial expenses in forming and establishing the business, high cost price of manufacture, and lack of working capital." In the opinion of the Official Receiver the failure is certainly partly attributable to the causes above-mentioned, but he considers that in addition, the company agreed to give too high a price for the assets of another company which it absorbed, and for certain inventions, processes and patents it acquired. The books of account appear to have been well kept. The claims of the creditors shown as unsecured amount to £1,369, for goods, &c., supplied, and work done for the purposes of the business of the company; £62 is in respect of law costs, and the balance for miscellaneous expenditure. In the opinion of the Official Receiver further inquiry is desirable as to the conduct of the business of the company."

The Electric Conversion Syndicate, Ltd.—A meeting is to be held on July 26th, at 1 and 2, Bucklersbury, E.C., to hear an account of the winding up from Mr. F. S. Salaman, the liquidator.

Thorium (Metal-Filament) Lamp Works Co., Ltd.—A meeting is to be held at 24, Coleman Street, E.C., on July 21st, to hear an account of the winding-up from the liquidator, Mr. J. C. Gardner.

Bankruptcy Proceedings.—E. J. Crosier (Crosier, Stephens & Co.), engineer and merchant, Collingwood Street, Newcastle-on-Tyne.—The debtor's statement of affairs shows a deficiency of £7,905. He alleges the causes of failure as follows:—"Increased competition and reduced commission on the engineering agency business, heavy expenses incidental to building up of new business, want of capital, heavy payments for insurance, interest and bad debts." The Official Receiver (Mr. C. Woollett, Newcastle-on-Tyne) in his observations says that the debtor commenced business in 1891 in partnership with an engineer, with £300 capital. The partnership was dissolved in 1895, and a Mr. W. J. Stephens joined the firm and paid the outgoing partner £500 for his share of the capital. The second partnership was dissolved in February, 1899, and the debtor paid Mr. Stephens about £360 by instalments. Since then the debtor has traded by himself, but has continued to use the style of "Crosier, Stephens & Co." Balance-sheets show a surplus of £734 in 1906, a deficiency of £242 in 1909, a deficiency of £2,629 in February, 1910, and a deficiency of £3,168 in August, 1910. On January 2nd, 1911, a company was formed called the "Cromil Engineering Co., Ltd.," which took over the debtor's trade mark called "Cromil," and acquired the right to sell the Cromil specialities, such as the Cromil header tube forcer, the Cromil polygon hand shaper, the Cromil Acheson graphite paint, the Cromil spraying machines, &c., in consideration of 3,000 £1 ordinary shares being handed to the debtor, who was appointed the managing director at a salary of £6 per week. Arrangements were also made for the company to pay £23 per month for the use of a room and clerical assistance at the debtor's premises in Collingwood Street. After the formation of the company the debtor was left with his numerous agencies and his business as a merchant. In March last he was pressed for repayment of a loan for £500, and on June 9th his bankers, who are scheduled as creditors for £2,196, holding a guarantee for £1,000, returned a cheque for £69. He was unable to continue trading, and on June 14th, 1911, a private meeting of creditors was held, when a statement of affairs was submitted showing liabilities £9,941; assets £1,721. The difference between the amount of the assets as compared with the present statement of affairs is caused by the book debtors being now estimated to produce a larger amount. The usual and proper books of account have been kept. The unsecured liabilities include £767 for money borrowed, £2,196 for bank overdraft. The balance of £2,964 is chiefly for trade debts incurred mostly in 1910 and 1911. The fully secured creditors are all for money advanced, in one case the loan of £500 has been outstanding since 1906. These creditors hold policies which are valued in the aggregate at £214 on the bankrupt's life. The first meeting was to be held on June 29th; public examination, July 13th.

W. H. ILLINGWORTH, electrical engineer, of Pellon Lane, Halifax, and formerly of Upper Fountaine Street, Leeds.—This public examination took place at the Halifax County Court on June 16th. Questioned by the Official Receiver as to his statement at the previous examination with regard to betting, the debtor denied that he said that all his transactions of that kind were for a Mr. Thompson. Some of them were for himself. Thompson was the name he knew the man by, but he could not say where he was. He had not lost a halfpenny in betting. The examination was closed.

Book Notices.—"Annual Reports on the Geological Survey, the Geological Museum, the Science Museum and the Solar Physics Committee, 1910." London: Wyman & Sons. Price 9d.

"*Journal* of the Institution of Electrical Engineers," Vol. XLVI. No. 207. London: E. & F. N. Spon, Ltd. Price 5s. The issue for May, 1911, contains the following papers: "Modern Long-Distance Transmission of Electrical Energy," by W. T. Taylor; "Extra-High-Pressure Transmission Lines," by R. Borlase Matthews and C. T. Wilkinson; "Merz-Price Protective Gear and other Discriminative Apparatus for Alternating-Current Circuits," by K. Faye-Hansen and G. Harlow; "Measurements of Relative Angular Displacement in Synchronous Machines," by W. W. Firth; "The Benkö Primary Battery and its Application," by W. R. Cooper.

The *Journal* of the Tramways and Light Railways Association for June contains an illustrated report on the results of Track Brake Block Tests undertaken by Mr. W. Thom, at the request of the Special Committee of the Association which is considering the question of "Brakes, &c."

"*Proceedings* of the Physical Society of London." Vol. XXIII, Part IV. June 15th, 1911. London: *Electrician* Printing and Publishing Co., Ltd. Price 4s.

"Ventilation of Electrical Machinery." By W. H. F. Murdock. 1911. London: Whittaker & Co. Price 3s. net.

How to Manage a Suction Gas Producer. By W. A. Tookey. London: Percival Marshall & Co. Price 1s. net.—This is one of those little manuals that fill an unmistakable want, and coming from the hand of a specialist on the subject dealt with, it may be relied upon to be the vehicle of sound and practical information. The author plunges at once into the producer, so to speak, and carries the reader with him through every operation connected with the starting-up and running of the producer, the construction of its various parts, its mode of working, its cleaning, &c., and the construction and management of the auxiliary apparatus, connections, &c. The contents are clear, concise and direct, and if carefully studied should enable any intelligent user to manage the plant with success and satisfaction.

"Practical Notes on the Working and Control of Steam Boilers." By J. B. C. Kershaw, F.I.C. Paper read before the Association of Engineers-in-Charge. From the author.

"Elektrochemische Umformer (Galvanische Elemente)." By Johannes Zacharias. 1911. Vienna: A. Hartleben. Price 4M.

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXX, No. 6, June, 1911. New York: The Institute. Price $1.0.

"*Journal* of the United States Artillery." Vol. 35, No. 3. May-June, 1911. "Index to Current Military Literature." Vol. 35. Jan.-June, 1911. Fort Monroe, Va.: Coast Artillery School Press.

"Les Lampes Electriques." By H. Pecheux. Paris: Gauthier-Villars.

An official history of the Post Office Services has just been published, containing particulars of the origin and development of the various branches of the department, including the telegraph and telephone systems.

"A Bibliographical History of Electricity and Magnetism (Chronologically Arranged)," by Paul Fleury Mottelay, is about to be issued by Messrs. E. and F. N. Spon, Ltd., at a subscription price of 24s. net (after publication, 31s. 6d. net).

Recent Improvements in Single-Phase Motors. By W. A. Layman. New York: James Kempster Printing Co.—A description of the new constant-speed single-phase motors made by the Wagner Electric Manufacturing Co. under the patents of Mr. V. A. Fynn.

"Il Nuovo Cimento." April, 1911. Pisa: Tipo. Toscano.

"Atti della Associazione Elettrotecnica Italiana." May, 1911. Milan: Stucchi, Cenetti e C.

Coronation Illuminations.—The Model Electric Home (Electra House) at Catford, which has been running for some time past, as our readers are aware, in the interests of the South Metropolitan Electric Light and Power Co., Ltd., has been brilliant without as well as within of late. Inside it has continued to convince the caller of the manifold different ways in which the convenience and comfort of the modern household may be added to by the use of electricity, and during the Coronation festivities it has by effective illumination cast a flood of light on the passer-by—let us hope it has penetrated to his mind. From a photograph that we have before us we should judge that the general effect was excellent; indeed, we are informed that Electra House had the most brilliant display in South London, which we will believe until someone convinces us of the existence of something better. In all there were some 411 lamps used, some being 8-C.P., and also some series strip with 14-volt 2-C.P. lamps. The strip used was of several makes, namely, "Fairyland," by the Imperial Lighting Co., "Alumarsh," by Messrs. Marsh, Son & Co., and "Striplite," by the Electrical Co., Ltd. The devices consisted of a 5-ft. crown (Fairyland) with 26 8-C.P. lamps and reflectors; 3-ft. letters "G" and "R," with 13 and 16 lamps respectively; also a 22-ft. Simplex flagstaff with 42 2-C.P. series lamps entwined round the pole and cross trees, and a 100-C.P. 200-volt Osram lamp at the top. The lights were festooned around the windows, under the eaves, and down the edge of the building. By special arrangement with the occupant of the premises at the opposite corner of the road, a line of 45 lamps was carried across the roadway, and the house was festooned in a similar manner to that adopted for "Electra" House. There was a special service to feed the installation controlled by two ironclad fuse-switches, and six-way double-pole distribution boards. The total load was about 75 amperes at 200 volts.

In addition to the list of contracts obtained by MESSRS. SIEMENS BROS. DYNAMO WORKS, LTD., already published in our pages, the firm were also responsible for the following, which were, as usual, sub-let, so far as all the fixing and erecting were concerned, to electrical contractors:—

P. & O. Steam Navigation Co., Northumberland Avenue.
Fitch & Son, Bishopsgate Street, E.C.
Russian Bank, 61-62, Gracechurch Street.
Royal Institution of Great Britain, 21, Albemarle Street.
Thames Iron Works.
Royal Yacht Club.

Catalogues and Lists.—MESSRS. BELL'S UNITED ASBESTOS CO., LTD., Southwark Street, London, S.E.—24-page brochure, entitled "Coronation Naval Review." It reproduces a useful table of the battleships, cruisers, &c., which took part in the Naval Review on Saturday last, and gives pictures of several. The company's asbestos goods have been supplied to the Admiralty for the past 30 years and are used throughout the Navy.

MESSRS. HANS RENOLD, LTD., Manchester.—New catalogue of 56 pages (No. 3/35), in which is given full illustrated information, together with tabulated sizes, weights, prices, &c., of their Bush roller chains and sprockets for general power transmission. A brief description of the chains and their construction, and a section on working load curves, are noteworthy points in the list. Copies of the publication can be obtained on application.

THE GLOBE ELECTRIC CO., LTD., 11, Farringdon Avenue, London, E.C.—Four-page list (P 51) describing, illustrating and giving prices of arc lamps for photographic purposes, blue-print reproduction, and drawing-office requirements. The "Photolumen" outfit, designed solely for the illumination of photographic studios, is particularised, also adjustable standard-pattern lamps, parabolic reflector-pattern reproducing lamp on hanging carriage, and standard-pattern photo-copying lamps.

MESSRS. J. DUGDILL & CO., Failsworth.—Leaflet relating to the "Constellum" electric shop-window fitting, enabling lights to be set at any desired position.

MESSRS. SIEMENS BROS. & CO., LTD., Caxton House, Westminster, S.W.—New 12-page pamphlet (No. R.S. 3), containing a finely illustrated description, on art paper, of the Siemens mercury-contact treadle for railway signalling, and instructions for its installation. Also leaflet No. 534 I, giving descriptive particulars and illustrations of watertight loud-speaking marine-type telephones.

NATIONAL ELECTRIC LAMP ASSOCIATION, Cleveland, Ohio, U.S.A.—Bulletin relating to the "Mazda" lamps with drawn-wire filaments.

ALLGEMEINE ELEKTRICITATS-GESELLSCHAFT, Berlin.—Brochure illustrating many examples of the main winding gears installed by the company, with brief descriptions of the systems employed, particulars of over 200 installations in all parts of the world, and illustrative diagrams of current, pressure, &c., in the use of the Ilgner and other systems of control. Also pamphlet relating to depth indicators and safety apparatus.

MESSRS. W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., Blomfield Street, London Wall, E.C.—New list tabulating sizes and prices of their twin paper-insulated house wires suitable for working pressures up to 250 volts. Copies will be sent to anyone in the trade, on application.

THE BRITISH ALUMINIUM CO., LTD., 109, Queen Victoria Street, London, E.C.—Three new leaflets; one illustrates the new rolling stock on the Metropolitan District Railway showing the aluminium handrails and car fittings supplied by the company; another shows the aluminium bus-bars and switchboard connections in a leading British power station; while the third relates to aluminium in the chemical factory.

Coronation Souvenir.—THE ELECTRICAL CO., LTD., issued to their friends last week a very choice brochure as a souvenir of the Coronation of the King and Queen. It contained particulars of the arrangements for the ceremony of Thursday, the route and order of the processions of that and the following day, and also of yesterday's visit to the City and North London. Excellent full-page portraits of King George and Queen Mary are given in the opening pages.

Royal Show, Norwich.—We are informed by Messrs. Siemens Bros. & Co., Ltd., that the stand of Messrs. Boulton and Paul, Ltd., electrical contractors of Rose Lane Works, Norwich has been wired with "Stannos" and fitted throughout with holophane reflectors and tantalum lamps. The show was opened officially by the King on Wednesday.

Electrical Trade at Wolverhampton.—The annual report of the Chamber of Commerce makes the following reference to the electrical engineering trade:—

"This industry during the past 12 months has been more busily engaged than in any former year. The application of electricity for power purposes is now being taken advantage of by almost every manufacturing trade in the world. The producing capacity is still, however, in excess of the demand, and the much needed improvement in selling price has not yet taken place, but the outlook in this direction is more encouraging than it has been at any time during the last six years. Colliery requirements for

electrical machinery have been very much reduced, owing to the uncertainty of the effect of the proposed new Home Office Regulations as to the use of electricity below ground. Local factories have been well supplied with orders, and have maintained their position in the markets."

Coronation Pressure at Siemens's.—MESSRS. SIEMENS BROS. DYNAMO WORKS, LTD., inform us that their energetic move keeping their Supplies Department at 39, Upper Thames Street, E.C., open all night on Wednesday last week was much appreciated by contractors, who kept the staff busy right through the small hours. No doubt more than one of the large shows would have been incomplete if there had not been some electrical supply firm to turn to in the dead of night.

India.—The Oerlikon Maschinenfabrik, of Oerlikon, Switzerland, are building three sets of 3,000-KW. high-pressure steam turbines and three-phase generators, and a 800-KW. turbine and generator for the Calcutta Electricity Supply Corporation. The generators are designed to give a pressure of 6,600 volts, and for a frequency of 50 cycles.

Electrical Trade in Russia.—The following information is from the report by H.M. Consul at Moscow (Mr. H. M. Grove) on the trade of that district in 1910, which will shortly be issued:—During 1910 there was a very considerable increase in Russia in the use of electrical energy, and, as a consequence, of the manufacture of electrical machinery in Russia. The greatest increase in the machinery produced was shown in the output of Diesel engines, of which as many were turned out last year as during the preceding five years. Owing to the increasing needs of municipalities, factories turning out cables, tramway and telegraph fittings, &c., extended their business. Mention may be made of the signs of activity which are apparent in provincial towns such as Orel, Tamboff, Kaluga, Smolensk, Minsk, Tula and Moghileff, all of which have important municipal projects (both electrical and other) in anticipation or in progress.—*Board of Trade Journal.*

British Vice-Consul at Krasnoyarsk, Eastern Siberia (Mr. H. J. S. Sykes) reports that goods, such as electrical, engineering and agricultural machinery, would find a good market there.

Trade Announcements.—We are informed by MESSRS. FRENE, AGAZZI & CO., of Sabadell, that in consequence of the growth of their business they have formed the concern into a limited company under the title of "La Electricidad," with Don J. Brutau as president and Don Emilio Frêne as managing director.

MESSRS. J. & H. GREVENER announce that owing to increased business, and for the purpose of centralisation of the different departments, they have taken over large premises at 40, Southwark Street, S.E., which from to-morrow, July 1st, will be their only address, offices, arc lamp works and warehouses, which have been previously scattered, being now brought under the same roof. Telephone: "No. 7180 City."

"Robertson" and "Osram" Social and Athletic Club.—On Saturday last a party numbering over 700 of the staff, employés and friends associated with the above went for their annual excursion. The company, which included Messrs. Wilson and Shepherd, Dr. Grisel, Messrs. Jessop, Beaven, Simmonds, Gosling, Pring, Heden, Hillmann, Adams, Harrington, Morgan, Ward, Willoughby, Arnold and Dallender (with Messrs. Jordon and Freeman who acted as honorary secretaries) went from Addision Road Station to Weston-super-Mare. Luncheon was served at the Grand Atlantic Hotel, and a drive to Cheddar for a visit to the caves followed, tea being partaken of on the return to the hotel.

LIGHTING and POWER NOTES.

Aldershot.—A L.G.B. inquiry was held on June 28th into the application of the U.D.C. for a loan of £2,500 for additional plant for the electricity works.

Barnes.—For the year ended March 31st last there is a profit of £2,201 on the electricity undertaking.

Barnstaple.—Messrs. Hopper & Slee have informed the R.D.C. that a company is being formed for the purpose of supplying the parish of Braunton with electric light, and that a provisional agreement has been entered into between the promoters and the Braunton Parish Council for the public lighting of the streets. The company applied for permission to place lamp-posts, &c., in the streets. The Braunton Council supported the application, which was agreed to.

Batley.—A B. of T. Inspector held an inquiry last week in connection with the appeal of the Yorkshire Electric Power Co. against the refusal of the T.C. to consent to the company laying mains in the Scothill Ward for the purpose of supplying energy to works. The company contended that they were empowered under their general powers to supply energy in Batley, but the case for the T.C. was that this could not be done without the consent in writing of the Corporation. The company agreed that this applied to part of the borough, but not to the Scothill upper area, which was added to the borough after the company had obtained their powers.

Bexhill.—The municipal undertaking has now 1,004 consumers. As the number of inhabited houses in the borough is only 8,019, the proportion using electricity is exceptionally large. During the past year 75,000 more units were generated. Owing to increased assessment, the undertaking had to pay £400 more in rates, otherwise the net profit for the year would have been £1,000

Blackburn.—The report of the borough electrical engineer, Mr. P. P. Wheelwright, for the year ended March 25th, 1911, states that the income was £38,372, the expenditure £19,324, and the gross profit £19,048; interest and sinking fund absorbed £17,351, and depreciation £1,000, leaving a net profit of £697, which was transferred to reserve. A large increase has taken place in the energy sold for power (exclusive of traction), the power supply now exceeding the output for lighting. The adverse effect of the metallic-filament lamps has come to an end, and they have greatly popularised the use of electricity. The total output for lighting and power was 4,836,000 units, an increase of 300,000; the motor-hiring department has installed 120 H.P., bringing up the total B.H.P. of motors connected to 1,400 (maintained by the department), in addition to 200 B.H.P. belonging to consumers. The total connections now amount to 209,640 equivalent 30-watt lamps, an increase of 7 per cent. For public lighting 208 arc and 478 incandescent lamps are used, consuming 344,407 units.

Bradford.—1,500 electric lamps are being used on the Town Hall, Bradford, for Coronation illuminations, and at the top of the tower are 24 2,500-C.P. lamps. In Forster Square a large illuminated fairy fountain has been constructed by the Electricity Department of the Corporation.

The Corporation received 61 applications for the special rate of Coronation illuminations, and the number of carbon-filament lamps supplied to private consumers was 11,812—equivalent to an extra load at the generating station of 404 KW.

Canada.—Our Canadian correspondent writes that Prince Rupert, B.C. Hydro-Electric Co. has been organised under the Companies' Act, Canada, for the purpose of developing power and supplying electric energy for light, heat, and motive power to the City of Prince Rupert, B.C., and industries in vicinity. The company has secured control of the Tsimpsean Light and Power Co., and of the Continental Power Co., and water rights on the Khtada and Falls Rivers, branches of the Skeena river. These water-powers are 42 miles from Prince Rupert, and are said to be capable of developing 25,000 to 30,000 H.P. It is proposed to develop 1,500 H.P. for the immediate demands of the new terminal city, and 15,000 H.P. within three years, and as soon as the Grand Trunk Pacific Railway is completed to Prince Rupert, its western terminal and ocean port, a gas-producing plant will be installed by the company. The capitalisation is $5,000,000, and it is proposed to issue $3,000,000 worth of stock at $500 per share, but now placed on the market at $462.50.

Chester-le-Street.—The B.G. has decided to obtain local estimates for wiring and electric light fittings for the whole of the Union premises. The present gas lighting costs £185, and the Durham Electrical Power Distribution Co., Ltd., advises the board that the cost of electricity will be less.

Clitheroe.—The T.C. has been informed by the B. of T. that the E.L. order has been revoked.

Collieries.—The Earl of Ellesmere is having additional surface buildings (electrically equipped) put down at his Bridgewater Collieries, Walkden, near Manchester. Messrs. J. Roscoe and Sons are having renewed electrical installations put down at their Peel Hall Collieries, Little Hulton, near Bolton.

Continental Notes.—SCANDINAVIA.—It is calculated that Sweden possesses water powers to the extent of 10,000,000 H.P., and Norway a further quantity of 28,000,000 H.P., and about 3,800,000 H.P. of the former and 4,800,000 H.P. of the latter should be capable of being used to economic advantage. These figures are, however, only estimated, as hydrographic surveys are now being made. In Sweden alone hydro-electric works representing 220,000 H.P. were in operation in 1907, and an increase to 450,000 H.P. had taken place since 1910, and will soon be raised to 600,000 H.P., whilst Norway will be in possession of works using 600,000 H.P. The distribution of the demand in Sweden is shown by the fact that out of the 450,000 H.P. in 1910 the timber industry was a consumer of 140,000 H.P., the iron and steel trades 80,000 H.P., the electrochemical industry 35,000 H.P., the textile industry 10,000 H.P., and the electric light and power industry 185,000 H.P.

FRANCE.—A company has just been formed in Paris, with a capital of £16,000, and the title La Compagnie Generale d'Electricité du Centre, to establish a central generating station for the supply of electrical energy for lighting and power purposes in the Creuse, Indre and Haute Vienne Departments of France.

La Société Energie Electrique du Sud-Ouest has recently completed a large water-power driven generating station at Tuiliere, near Bordeaux. Among the undertakings to which it is supplying current are the Compagnie Generale d'Eclairage de Bordeaux, the Société des Tramways Electriques et Omnibus de Bordeaux, La Société de Gaz et de l'Eléctricité de Bergerac, and to the Paris-Orleans Railway Co., for lighting and power purposes at the railway works at Perigueux.

HUNGARY.—The establishment of a large municipal central electricity undertaking in the city of Budapest is at present under consideration.

Dawlish.—The U.D.C. has passed a resolution to give the Gas Co. three months' notice to terminate the contract for lighting the town. Dawlish has now an electric light station. A company was promoted some 12 months ago. The station, which is situated

in Brook Street, was erected by Messrs. Abell & Sons, of Exmouth. It consists of an engine room, a battery room, engineer's office, coal and ashes sheds, and the usual offices. The 40-H.P. engine is by Messrs. Garrett & Sons, of Leiston, Suffolk. The dynamo and the switchboard have been supplied by Messrs. Crompton & Co., Ltd.

Donaghadee.—At the monthly meeting of the Town Commissioners last week, the town clerk was instructed to ascertain from the town solicitor if it would be possible to obtain powers in the electric lighting provisional order to enable the Council to supply electricity, if required and decided on, outside the urban district area.

Ealing.—The L.G.B. has sanctioned the following loans for electricity purposes:—£7,000, extensions of mains; £6,000, services; £5,000, meters; £500, transformers.

Epsom.—The U.D.C. has decided to apply to the B. of T. for an order to authorise it to give a supply of current to premises at Ewell, close to the U.D.C. boundary.

Erith.—The U.D.C. has reduced the charge for energy for heating and cooking to 1½d. per unit, and the charges for hire of meter, wiring, &c., to 10 per cent. of the capital outlay.

Fleetwood.—The U.D.C. has adopted the following reduced scale of charges for energy:—

Lighting: First 500 units, 4½d. per unit; second 500, 3½d.; beyond, 3d. For quarterly consumption, about 2,000 units, a flat rate of 3d. Prepayment meters up to five ampères, for lighting, 5d., with no meter rent. Cinematograph machines, 3½d. if supplied off 200-volt mains. Motor-generators if off 400 volts circuit, at power rates. For current supplied to the Council's premises the flat rate of 4d. per unit is to remain. Power: First 500 units, 2d.; beyond, 1½d. Heating: 1½d.

Hayle.—Early on Sunday morning, last week, an accident happened to a new electric line which is being erected in the neighbourhood of Hayle. The Electric Supply Co. at Camborne has constructed a new generating station close to Hayle Docks for the supply of current to certain mines in West Cornwall; it is also to supply electric power to a new tin dredge which is being laid down in St. Erith Valley. For the latter purpose a branch line is being run from the Hayle power station to St. Erith (but it has not yet been connected) on iron poles set in cement. From the station the wires take a course across the mud flat until they reach the high road at Hayle Causeway. At half-past two in the morning a localised gale struck along the track of the poles and blew 25 of them down, together with the wires attached to them. The poles were not snapped off, but were absolutely bent down, some of them even touching the ground. The first pole that collapsed under the force of the gale was just on the Penzance side of the Hayle Pool, the remaining 25 following in succession for a considerable distance in the direction of the causeway. Poles and wires all lay on the mud in a wrecked condition. At the time of the mishap, some gipsies were sleeping under canvas upon a waste piece of ground on the edge of Hayle Pool, and they were startled by the falling of wires upon their tent. Had the wires been in working order, the whole family might have lost their lives. In addition to the 25 poles, the four miles of cable were torn down. The damage is estimated at several hundred pounds. The gale also dislocated the National Telephone Co.'s wires to St. Ives, Penzance.

Herne Bay.—At a meeting of the U.D.C. on June 21st it was reported that the Gas Co. were prepared to negotiate with the Council with a view of taking a transfer of the Council's E.L. order, 1909. The chairman of the Law and Parliamentary Committee and the clerk will interview the company's officials regarding a suggested agreement.

Heywood.—Mr. J. Stott, electrical engineer and tramway manager, states in his annual report that on the Electricity Department there is a loss of £2,044 for the past municipal year. Nearly £1,200 of this is accounted for by payment for discarded plant ordered by the L.G.B. to be made in three years, and the report urges that a longer time should have been allowed for this seeing that the plant was not discarded as unworkable, but because it was too small and uneconomical in working.

Hornsey.—A cable is to be laid in Wightman Road, Harringay, at a cost of £390. The annual accounts of the Electricity Department for the year ended March 31st, show that the receipts from private consumers amounted to £18,017, as against £15,699 in the previous year. The total receipts were £19,752, or an increase of £2,407. The net surplus was £1,922, and adding this to the balance of profit on the previous year, the total came to £3,102, which was almost sufficient to provide the necessary working capital for the undertaking.

India.—The demand in Calcutta for electricity both for lighting and power is increasing so rapidly, that it has been extremely difficult for the Calcutta Electric Supply Corporation to keep pace with it by extensions of plant. It is impossible to put more plant into some of the existing generating stations owing to the restrictions of the sites, and as there is at the present time a special demand for electric power for factories, mills, &c., it has been necessary to reorganise the whole system of supply with a view to meeting this demand. A very large generating station is now being built on the river bank by Cossipore, where 10,000-KW. turbo-generator sets are being put in. This only represents half the station as it is ultimately designed, and it could be again doubled if found necessary. Current is generated at H.T. alternating, and is converted to L.T. direct current at sub-stations placed on the sites of the older steam generating stations, which will be shut down, and also in other places where the demand for current is greatest. The equipment of these sub-stations has already commenced, and work has also been started on the large generating station at Cossipore. It is estimated that this generating station will be running before the cold season next year. Electricity will, of course, be supplied to the consumers exactly as before, as direct current at 225 volts, and the change from one system to the other at the generating stations will be carried out without interference with the supply. In addition to the D.C. supply, large consumers of power can be supplied from the H.T. alternating-current mains.

Itchen.—The U.D.C. has passed a resolution instructing a Committee to report on means for securing electricity supply powers.

Japan.—An agreement has just been adopted between the municipal authorities of Yokohama and the Yokohama Electric Light Co. with regard to the compensation payable by the latter by way of compensation for the use of the public roads, &c. The chief points of the agreement are that the Electric Light Co. shall pay to the municipality 6 per cent. of the net receipts for electrical energy supplied; that the company shall make a reduction of three-tenths in the charges for lighting the streets, bridges, public parks, hospitals and other public buildings maintained by the municipality; that the municipality shall give the company every facility for the erection of electric light poles and any embankments which may be undertaken by the company in the streets, public parks and other places under the jurisdiction of the municipality, and that no special tax shall be imposed thereon. The agreement is to remain in force for ten years, from October 1st next.

A keen price war has apparently been started between the Tokio Railway Co. and the Tokio Electric Light Co. Formerly these companies each charged 1·20 yen (about 2s. 4½d.) per month for a 10-C.P. lamp. The railway company some time ago began to reduce its charges, which now stand at about 1s. 7½d., and the Electric Light Co. has now announced a similar reduction.

Kendal.—The accounts of the electricity undertaking for the year ended March 31st show that the total receipts on revenue account amounted to £1,289, expenditure £977, gross profit £312. Interest and instalment on loan, including bank interest and commission, absorbed £881, leaving a deficiency of £568. The total number of consumers was 140. The output sold for lighting was 40,401 units, and 17,730 for power, making 58,131 units, an increase of 2,537 units. The total cost per unit generated was 2·87d., which was ·015d. higher than in the previous year.

Leatherhead.—Recently the U.D.C. invited tenders from the electricity and gas companies for lighting the town, and the gas company's tender was accepted in spite of the fact that it exceeded that of the electricity company by 10s. a lamp. The Council defended its decision by saying that the electricity tender was for seven and five years, instead of three and five years as requested. The unsuccessful company have now written to the Council to know whether the candle-power of the gas was as high as what they offered, whether the misstatement that their lamps would be put out at 11 p.m. has been corrected, whether the gas company undertook to replace mantles and lamps, and whether it was proposed to enter the offers of the two companies on the Council minutes. It is stated that the Council's action has resulted in a loss to the town of £94.

Llanelly.—The Gwaencaequrwen Colliery Co. are installing an electrical plant at their Gwaencaequrwen Pit, near Llanelly. The total cost is expected to be £30,000.

Llandudno.—The Council is to apply to the L.G.B. for sanction to borrow £385 to improve the lighting of the Promenade by erecting 28 additional columns. The Electricity Committee is considering the question of reducing the charge, which to ordinary consumers is now 5½d. per unit.

London.—BETHNAL GREEN.—At the last meeting of the B.C., the Electricity Committee reported that the Council on February 16th last sanctioned the Shoreditch B.C. making application to the B. of T. under Sec. 6 of the Electric Lighting Act, 1909, for an order to sanction that Council supplying Bethnal Green consumers. The B. of T. has since informed a Bethnal Green deputation that Sec. 6 of the Electric Lighting Act, 1909, did not bear the interpretation that the Shoreditch Council sought to put upon it, and that it was of opinion that the power vested in the Board under the Section was not intended to apply to such an extensive supply as was included in the application from the Shoreditch Council. The Board considers that an order made under the Section should relate either to separate premises, or possibly, in certain cases, where special circumstances exist, to a few premises situate within a reasonable distance of the border of the supply district of the body applying for the order. Mr. Tennant pointed out that the total demand already existing amounted to 700,000 units per annum, and that therefore the Bethnal Green Council with a large business ready to hand should arrange for a supply to be given. Mr. Tennant suggested that the Bethnal Green B.C. should be its own electricity supply undertaker, and obtain a bulk supply from some neighbouring authority and distribute it within its own area of supply. Reference was made to the non-exercise by the Council of its powers under the Provisional Order of 1899, and the chairman of the Committee informed Mr. Tennant of the steps taken by the Council at various times to obtain a supply. Having given the matter careful consideration, the Committee thinks that it is necessary that the Council should take steps to enable it to supply electricity to persons

in the borough who require it, and that the services of a competent person should be engaged to prepare a scheme. The Council will therefore engage a consulting electrical engineer for the purpose of preparing a scheme for a supply of electricity, upon which tenders can be invited by the Council, and at a fee to be determined by the Committee.

WESTMINSTER.—The City Council has been receiving energy from the Charing Cross, West End and City Electricity Supply Co., Ltd., the St. James's and Pall Mall Electric Light Co., Ltd., and the Metropolitan Electric Supply Co., Ltd., at 2½d. per unit for light and 2d. for power. As the Contracts Committee was informed that the Council obtained energy for power purposes from another company at a cost of 1d. per unit, inquiries were made of the three above-mentioned companies whether they would be prepared to make a reduction to that figure. The Charing Cross Co. and the Metropolitan Co. replied that they were unable to do so, but the St. James's and Pall Mall Electric Light Co. intimated that it was prepared to modify its charge for power to 1d. per unit, together with a fixed charge of 7s. 6d. per rated H.P. per quarter. The contracts with two of the electric light companies are to be renewed for a further period of 12 months from June 24th on the same terms as before, and with the St. James's and Pall Mall on the terms of the reduction consented to by it.

FULHAM.—The borough treasurer reports that up to March 31st last, the outstanding capital of the electricity undertaking amounted to £235,327. The total capital repaid was £36,321, which was equal to 13·37 per cent. of the total loans taken up. The revenue account for the past year showed a gross income of £33,001, as against £32,896 for the previous year, while the expenditure amounted to £28,730, as against £28,330 for the preceding year. The net profit was £3,861, as against £4,551 for the preceding year. The total number of units sold for private purposes during the 12 months was 2,345,847, and the average price 2·45d. per unit, as against 2,202,287 units and 2·5d. in the preceding year. The percentage of increase in the units sold, as against the preceding year, was equal to 6·5. There was a decrease in the public lighting supply which represented £71.

BERMONDSEY.—The accounts of the electricity undertaking for the year ended March 31st last show a surplus of £1,645. The gross profit increased from 6·6 per cent. to 7·2 on the capital outlay. The estimate for the year ending March 31st, 1912, is based on 4,650,000 units being sold, *i.e.*, 12½ per cent. increase on the previous year. The total cost per unit decreased during the year from ·71d. to ·65d.

LAMBETH.—In reply to a letter from the town clerk on lamps reported out, the South London Electric Supply Corporation, Ltd., wrote that they had been experimenting with various makes of time switch to switch the lamps on and off automatically at the agreed times, but so far these time switches had in several instances failed to operate satisfactorily. "This we find to be due to the exceedingly cramped space in which the switches have to be fixed in the bases of the pillars, and we, therefore, find it necessary to abandon any further experiments on these lines. Under these circumstances, we have had another type of switch constructed, which under test has proved itself entirely satisfactory. It is, however, too large to be accommodated in the base of the pillar, and must, therefore, be fixed on the outside of the pillar. We are having this sample switch fitted to the pillar at the junction of Coldharbour Lane and Brixton Road, and shall be glad if you will give us permission to erect the same type of switch on the remaining 24 pillars, the completion of which work will then complete the arc lighting system, and we are perfectly sure that there will not then be any cause for complaint as to lamps not switching on and off at the agreed times." The Lighting Committee reports that it is essential that every possible care should be taken to ensure the lighting-up at the proper time of all the public arc lamps, and as it seems that the arrangement suggested in the letter is the only way to obtain effectual lighting of the lamps, the Committee has decided that although the suggested switches rather detract from the appearance of the columns, the permission desired should be granted.

Mansfield.—The Education Committee has accepted the offer of the T.C. for electricity for lighting Carter Lane schools, at a flat rate of 4d. per unit.

Northwich.—The U.D.C. is negotiating with the Electric Supply Co., Ltd., for extending the cables so as to supply power to the main pumping station at the sewerage works.

Oldham.—The working of the Corporation electricity undertaking for the year shows an increase of 122,140 units sold, and £918 increased revenue for lighting purposes, but there is a decrease of 102,631 units, and £534 for traction, and an increase of £996 in the amount paid for interest and sinking fund, leaving a net profit of £1,300, against £2,203 last year. This included a sum of £384, the cost of fixing feeder pillars which should be allowed out of reserve, and which would bring the net profit to £1,684. In 1910-11 the units sold for private lighting were 1,381,386, and the revenue £15,507, against 1,259,246 units, and £14,589 in the previous year; sold for power, 583,553; revenue £2,805, against 577,922 and £2,785. For public lighting 26,131 units, £251 revenue; against 22,631 and £277. Traction, 3,757,901 units, £23,218 revenue; against 3,860,532 and £23,753. Total units 5,748,971, revenue £41,781; against 5,720,331 and £41,355 respectively. The gross revenue for the year was £42,920, gross expenditure £22,683; gross profit £20,237. It was resolved that the flat rate of 4d. per unit be reduced to 3½d. per unit for all classes of consumers, both ordinary and slot meters, plus meter rents; also that the present rate of £2 10s. per KW. per annum, plus 0·5d. per unit metered, be reduced to £2 10s. per KW. per annum, plus 0·4d. per unit metered to consumers of 25 H.P. and over. A councillor remarked on the action of the Manchester Electricity Committee, which, he said, was selling energy in the Oldham area at one-quarter of the price at which it could make it.

Redditch.—The accounts of the U.D.C.'s electricity undertaking for the year ending March 31st, 1911, have just been issued, and show that the consumers have increased from 682 to 743, the equivalent number of 8-C.P. lamps connected from 41,125 to 46,120, the increase mainly representing power and heating, and the units sold from 144,699 to 172,642 for lighting, and from 451,607 to 602,797 for power and heating. Street lighting absorbed 130,720 units, and the total amount generated was 956,806 units. The receipts amounted to £6,834, of which £1,028 was for public lighting; expenses were £5,028, leaving a balance of £1,806. Interest and sinking-fund payments absorbed £2,682, which with other items was covered by a grant of £3,000 from the rates, leaving a balance carried forward of £1,235. Works costs amounted to 1·06d. per unit, and total costs to 1·19d., as compared with 1·36d. in the previous year.

South Africa.—CAPE TOWN.—The Corporation electrical engineer notified consumers that electrical energy would be supplied free of charge for illumination purposes on Coronation night, provided applications were received not later than June 1st. The Corporation illuminated the City Hall, the Jetty and Adderley Street.

From July 1st a reduced tariff for electrical energy comes into operation, as follows:—

For lighting.—Sliding scale maximum, 9d. per unit to 6d. per unit; minimum charge of 5s. per month, and no meter rent. Lighting between midnight and sunset is charged at half rate where a two-rate meter is provided.

For power, heating and cooking.—Sliding scale, maximum 2½d. per unit to 1d. per unit.

CLAREMONT (near Cape Town).—The Cape Peninsula Lighting Co. have written to the Claremont Municipal Council, informing it that electrical energy for lighting purposes will be reduced on January 1st next from 1s. 6d. per unit, less 10 per cent. cash discount, to 1s. per unit. The minimum monthly charge also is to be reduced from 10s. to 7s. 6d.

KIMBERLEY.—The price of electrical energy is to be reduced from 1s. per unit to 6d. per unit. The Council is also considering means of inducing consumers to take more electric power.

JOHANNESBURG.—The Corporation power station had a temporary breakdown recently, when No. 3 1,000-KW. Belliss-Dick Kerr generator was thrown out of action by a slight engine explosion. Damage was done to the extent of about £250. The necessary repairs are being proceeded with, and arrangements have been made to obtain a temporary supply of energy from the Robinson Mine. It was expected that the new 3,000-KW. turbine would have been running by June 1st.

Torquay.—The L.G.B. will, on July 4th, hold an inquiry *re* the Council's application to borrow £5,000 for additional plant at the electricity works.

Walthamstow.—Sanction has been received from the L.G.B. to borrow £9,260 for electrical plant. Application is to be made to the Board for sanction to borrow £1,485, the estimated cost of laying a feeder cable from Barrett Road to Fulbourne Road

Watford.—The Bushey U.D.C. has consented to the Watford U.D.C. giving a further supply of energy to the works of Messrs. André & Sleigh.

West Ham.—With reference to the fixed-price lighting scheme previously before the Electricity Committee, the electrical engineer reported that the prospective customers were unable to postpone the matter further. In addition, the preliminary discussion with the Intermediary Co. did not produce any satisfactory results. He had, however, reason to believe that terms could be arranged by means of which the Council could supply a company who would retail direct to the consumers. While, from many points of view, it would, perhaps, be desirable to keep the whole of the business in the hands of the Corporation, yet he did not anticipate that the Council could at present, at any rate, secure a loan from the L.G.B. on such terms as would enable it to put forward a scheme attractive to the consumers and on sound business lines. The main object of this scheme is to introduce electricity into a class of property which is at present hardly touched, due to the cost of installation and the fact that other illuminants are available. The Committee decided not to entertain the idea of the supply of energy through the intermediary company referred to, but considered that the matter should be referred to the town clerk and the electrical engineer to consider the desirability of including a clause in the next Bill in Parliament to obtain the power suggested. The Electricity Committee empowered the electrical engineer to negotiate for a portion of a stand at the Electrical Exhibition to be held at Olympia during this year at a cost to West Ham not exceeding £30, and to purchase admission tickets up to an amount of £10 for distribution to existing and proposed customers within the borough.

Wombwell (near Barnsley).—The Electrical Distribution Co., Ltd., having notified the U.D.C. of its intention to apply for a prov. order to introduce electric light in the district, the latter is appointing a sub-Committee to consider whether steps should be taken to apply for an order for Wombwell and Darfield.

Wood Green.—At the last U.D.C. meeting the electric light scheme prepared by Mr. Spencer Hawes was discussed at some length. The scheme would involve an outlay of £21,000. The proposal was to obtain a bulk supply from the North Metropolitan Electrical Supply Co., and for the Council to distribute it. It was reported that the clerk to the Council had communicated with the

occupiers of the premises situated in the streets in which it was proposed to lay distributing mains, with the object of ascertaining to what extent the light would be taken; 1,431 circulars, with reply postcards enclosed, were sent out, with the following result:—In favour at present, 110; in favour in future, 19; doubtful, 98; against, 337; number of postcards not returned, 867. A resolution to open negotiations with the company for the purpose of ascertaining the terms which they would be willing to offer the Council for the purchase of the Wood Green Electric Order, 1902, to enable the company forthwith to supply electrical energy to Wood Green for lighting and other purposes, was proposed. After some debating, the resolution was dropped in favour of another disapproving of the £21,000 scheme, which was carried. It was stated that the Council had spent £1,200 in connection with electric lighting, and that there ought to be some return. A suggestion was made that the Council should approach the company with the object of obtaining a *quid pro quo*. Nothing, however, was done, as it was felt that a matter of negotiation of this kind should be taken in Committee.

Worcester.—The T.C. has reduced the price of energy for the outside lighting of shops, where there is interior lighting, from 5d. to 3d. per unit, and abolished the graduated fixed charge for heating and cooking, leaving the 1d. per unit for energy unaltered, with a nominal charge of 1s. 3d. per quarter for hire of meter.

The L.G.B. held an inquiry last week regarding the proposed borrowing of £3,375 for electricity supply purposes; reference was made to the decision to change over to the polyphase system.

TRAMWAY and RAILWAY NOTES.

Blackburn.—The electric tramcars belonging to Darwen and Blackburn Corporations were beautifully decorated on June 22nd, and were the cause of much comment.

Bradford and Leeds Railless Cars.—On the 20th inst. the Corporations of Leeds and Bradford simultaneously inaugurated their respective systems of railless traction, though the full service of cars on all the routes equipped could not then be started. The route from Leeds to Farnley was traversed by two trolley cars and a number of automobiles containing members of the Corporation, and on their return, luncheon was served in the Town Hall. At Bradford, the route from Laisterdyke to Dudley Hill was opened, and the city councillors and officials then proceeded by special cars to Leeds to join the luncheon party there. We shall give particulars and illustrations of the cars and equipment in an early issue.

Continental Notes.—FRANCE.—Plans are being prepared in respect of a projected light electric railway between Pau and Lourdes. The Compagnie des Chemins de Fer et Tramways Electriques des Basses-Pyrenees is interested in the scheme.

BELGIUM.—La Société des Tramways Electriques du Pays de Charleroi has secured a concession for an electric tramway between Charleroi, Ville-Haute and Couillet-Queue, with a branch to Couillet-Centre.

Heywood.—The annual report shows that for the past year there is a deficiency on the tramways department of £1,404, which includes a yearly payment of £1,066 for sinking fund on the amount awarded to the old steam Tramway Company. Car-miles run were 275,064, against 288,086 for the previous year; passengers carried 2,084,396, as compared with 2,181,751. The receipts were £10,911, against £11,207; per car-mile 9·56d., against 9·234d.

Huddersfield.—The tramways manager has been requested to report on the question of extending the tramway to the following places: Brighouse, Mirfield, Marsden, Dodlee, Longwood, bottom end of Dalton, New Mill and Grange Moor. The manager is also to obtain tenders for ten new cars similar to car No. 71.

Keighley.—The T.C. is being asked to insert in the forthcoming Parliamentary Bill clauses authorising the running of railless trolley vehicles and motor-'buses to Sutton, Nab Lane (Bradford main road), Oxenhope and Lane Ends, Oakworth.

Llanelly.—The B. of T. has inspected and approved of the electric tramways, and they have now been opened for public traffic.

Merthyr Tydfil.—The T.C. has appointed a Committee to consider the advisability of approaching the Electric Traction and Lighting Co., Ltd., to ascertain whether they are disposed to sell the whole of their undertaking within and adjacent to the borough, and to consider the advisability of applying for powers to construct an electric tramway between Merthyr and Treharris.

Mirfield.—A proposal is on foot for extending the electric tramway at Fir Cottage, Ravensthorpe, to Mirfield and Battyeford.

Morecambe.—The T.C. is to apply to the B. of T. to prolong the time for the commencement and completion of tramway No. 3, authorised by the Tramways Order of 1909, and for permission to borrow £4,617 for doubling the track, and £800 for additional cars.

Russia.—Messrs. F. A. Lipski and A. W. Below propose to form a company for the construction and working of an electric railway from Moscow to the Ssergievski Possad, with branch lines to the Northern Railway. The lines would be some 70 versts (about 46 miles) long, and the cost of construction is estimated at 8,674,900 roubles (about £915,000). The project has been submitted by the Ministries of Finance and Ways of Communication to the Council of Ministers.—*Board of Trade Journal.*

Stoke-on-Trent.—The Corporation Electricity Supply Committee has received a letter from the Chairman of the Potteries Electric Traction Co., Ltd., inviting the Council to enter into negotiations for the purchase of the tramway power stations. The Committee resolved to reply that, after careful consideration, it could not see that the borough would derive any advantage by accepting the offer contained in the communication.

The Tramway Committee has received a letter from the same company with regard to the latter's application for an extension of their tenure of the lines, which the Corporation has the option to purchase in 1917, suggesting that a deputation from the Council might meet the directors with a view to an arrangement being arrived at. The Committee, in reply, has requested the company to place their views in writing before the Committee, and states that when this has been done the question of appointing a deputation to meet the directors will be considered.

Swansea.—The Corporation Tramways Committee has adopted the principle of purchasing the tramways at an equated period of 30 years. It is also suggested that the right of being paid £1,000 a year by the Mumbles Railway Co. in lieu of exercising their running powers to the Mumbles be transferred to the Corporation, and that if the company make any future extensions they shall take their energy from the Corporation.

Wakefield.—The B. of T. has been asked to sanction the sale of the undertakings of the Wakefield and District Light Railway Co. to the Yorkshire (West Riding) Electric Tramways Co., Ltd.

West Ham.—The total income of the tramways department for the year was £131,542, and there was a net profit of £19,542 as compared with £18,409 for the previous year.

TELEGRAPH and TELEPHONE NOTES.

Australia.—In order to test the working of the Sydney telephone service, a special commissioner has been appointed to spend a month in calling subscribers from all parts of the district, and to report on the time taken in answering calls, the accuracy of the service, and other points connected with the operation of the exchanges.

The telephone lines at Rockhampton, Queensland, are being laid underground, and a new exchange is to be erected.

An Automobile Wireless Telegraph Plant.—The Austrian War Office has lately added an automobile wireless telegraph plant to the equipment of the Military Railway and Telegraph Corps. The wireless telegraph outfit, which is on the Siemens and Halske system, is carried on a special 28-32-H.P. chain-driven car built by the Austrian Daimler Motor Co. The petrol motor, which is provided with an automatic speed governor, is so arranged that it can be either connected up to the driving mechanism of the vehicle or coupled up to an A.C. generator and a D.C. exciter used in connection with the wireless telegraph installation. The mast is made telescopic, so that it can be carried on the roof of the car; when extended it measures 98 ft. In addition to the driver, accommodation is provided for six passengers, so that by means of the new machine the Austrian Army authorities are able to establish a wireless telegraph station at any point in a minimum of time, the vehicle being able to carry its full load at a speed of 25 miles per hour.

Coronation Telegrams.—The *Daily Telegraph* states that the Press telegrams dispatched from London to the provinces and foreign countries on Thursday last week amounted to the large total of 847,000 words. On the following day, that of the Royal Progress, 370,000 words were dispatched at Press rates. Both foreign and provincial messages shared in the increase, which has to be compared with an average daily total of from 150,000 to 200,000.

Telephone Engineers' Trial.—The Brussels correspondent of the *Times* reports that the English engineers who were acquitted of a charge of stealing documents relating to the manufacture of the Bell telephone have brought a civil action against the company, and claim £8,000 damages for malicious prosecution. The case is being heard in the First Civil Chamber in Antwerp.

Wireless Telegraphy.—Pending the completion of the wireless station at Pennant Hills, the Federal Government of Australia has made arrangements with the Australasian Wireless, Ltd., to send and receive private messages by means of a station on the Australia Hotel, Sydney, at a charge of 10d. per word (minimum 8s. 4d.). So many private stations are at work in Sydney under licence that the Government has had to consider the question of restricting their operation in order to prevent confusion.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Victoria.—P.M.G.; 150 miles insulated wire and five miles of telegraph cable. See "Official Notices" June 16th.

July 19th.—Insulators, telephones, copper wire and iron wire, for the P.M.G.'s Department in Queensland. See "Official Notices" June 2nd.

August 8th.—Measuring instruments, telephone instruments, bells, &c., for the Deputy P.M.G., Melbourne. High Commissioner, 72, Victoria Street, S.W., and Board of Trade C.I. Department.

August 14th.—Dynamo and booster, storage battery, switchboard, wires and cables, for the Mortlake Butter and Cheese Factory Co., Ltd., Mortlake, Victoria. Specifications 10s. 6d., from F. A. McCarty & Co., consulting engineers, 31, Queen Street, Melbourne. A copy may be seen at Board of Trade C.I. Department in London.

August 15th.—80,000 insulators and india-rubber-covered wire, for the P.M.G.'s Department. See "Official Notices" to-day.

Brisbane.—January 30th, 1912. For the Metropolitan Water and Sewage Board:—One, two or three complete units, consisting of power-generating plant or plants, and pump or pumps, to raise from the suction wells through the delivery mains, through a total vertical lift of 400 ft., exclusive of the head due to friction, &c., not less than 6,000,000 British imperial gallons per day of 24 hours. Particulars from Mr. G. Johnston, secretary, office of the Board, Albert Street, Brisbane, Queensland.

Hobart.—July 31st. P.M.G. Telegraph and telephone material.

Melbourne.—August 15th. Deputy P.M.G. 20,000 stoneware and 60,000 porcelain insulators. Brisbane.—August 16th. Deputy P.M.G. Various paper-insulated lead-covered cables, also telephone switchboard cable, covered wire, iron wire, steel standard wire, 158 tons of 3-in. cast-iron pipes, 1,400 tubular iron or steel poles, 6,020 insulators, copper wire, &c. Copies of these specifications, &c., at office of High Commissioner for the Commonwealth in London, and at the Board of Trade C.I. Department.

Queensland.—August 23rd. Letter box fronts, for the P.M.G.'s Department. See "Official Notices" to-day.

South Australia.—August 9th. (*a*) Letter box fronts; (*b*) four petrol motor cars, for the P.M.G.'s Department. See "Official Notices" to-day.

Melbourne.—July 18th and 21st. (*a*) 4 tons, 6 cwt. of bare hard drawn copper cables, and (*b*) 35,700 incandescent lamps, for the City Council. See "Official Notices" to-day.

Aldershot.—July 4th. 135-kw. Diesel direct coupled engine and dynamo for the U.D.C. electricity works. Engineer, Electricity Works, Laburnum Road. Two guineas deposit.

Belfast.—July 17th. Circulating water and motor-driven air pumps, for the Corporation Tramways and Electricity Committee. See "Official Notices" to-day.

Bulgaria.—August 4th. The municipal authorities of Philippopolis are inviting tenders for the concession for the electric lighting of the town and for the construction and working of a system of electric tramways during a period of 50 years.

Cardiff.—July 14th. Cables, economisers and induced draught installation, for the Corporation. "See Official Notices" June 23rd.

Cowdenbeath.—July 10th. Diesel oil engine and continuous-current generator, for the T.C. See "Official Notices" to-day.

Dublin.—July 5th. The Great Southern and Western Railway (Ireland) are inviting tenders for arc lamp carbons. Specifications and forms of tender, 6d. (not returnable), from the Storekeeper, Stores Department, Inchicore, Dublin.

Germany.—The Prussian State Railway authorities have just invited tenders for the construction of two electrically-operated luggage lifts at the railway station at Langendreer.

Heston and Isleworth.—July 5th. Electric lighting for certain schools for the Urban District Education Committee. Mr. P. E. Rycroft, Electricity Works, Hounslow.

Italy.—July 11th. (*a*) Electric light bulbs and (*b*) lamp brackets of special type (estimated value £1,060), for the Royal Arsenal at Spezia. Deposit, £75 for (*a*) and £52 for (*b*). Local representation. Conditions and specifications (in Italian) at Board of Trade C.I. Department in London.

Jerusalem.—The date for receipt of the tenders for the electric power and tramway concession has been extended to September 13th. Local representation. Ministry of Public Works, Constantinople. Specification in French can be seen at the Board of Trade C.I. Branch in London; also a list of British commission agents established in Constantinople.

London.—July 4th. Four electric traversers for car-sheds. See "Official Notices" May 26th.

June 30th.—Surface condensing plant at the South Kensington generating station, for H.M. Office of Works. See "Official Notices" June 2nd.

Hammersmith.—June 30th. 600 time switches for individual street lamps, for the B.C. See "Official Notices" June 16th.

Battersea.—June 30th. 440 street lighting lanterns for metallic-filament lamps, for the B.C. See "Official Notices" June 23rd.

Shoreditch.—60 meters (10 to 50 amps.) and 84 indicators (5 to 100 amps.) for the Electricity Department. Estimated cost, £260.

Londonderry.—July 7th. Wiring, fittings, &c., for the new Guildhall lighting for the Corporation. See "Official Notices" June 16th.

Olympia Exhibition.—July 10th. The Executive Committee of the Electrical Exhibition invite estimates for an electrical sign to be fixed outside Olympia for use during the period of the Exhibition. See our advertisement pages to-day for further particulars.

Redditch.—July 10th. Single-phase alternator coupled to a Willans steam turbine, condensing plant and pipework, for the U.D.C. See "Official Notices" to-day.

Rotherham.—July 8th. Single vulcanised bitumen-covered cable (various sizes), smudge or pea nuts for a year from October 1st, and meters; Borough Electrical Engineer. Also stores and materials for the tramways department for a year. Tramways Manager.

Russia.—Augnst 14th. The municipal authorities of Strawndpol in the Caucasus are inviting tenders for the concession for the construction and working of an electric tramway in the town.

Salford.—July 3rd. 35-kw. belt-driven continuous-current generator. Borough Electrical Engineer, Frederick Road, Pendleton.

July 17th.—One water-tube boiler with superheater, for the Corporation Electricity Department. See "Official Notices" to-day.

Spain.—July 4th. Tenders are wanted by the "Sección Colonial del Ministerio de Estado," Madrid, for the complete installation of a wireless telegraph station on the island of Fernando Po, for the purpose of carrying on telegraphic communications in the Gulf of Guinea. For further particulars see this column last week.

Tenders have just been invited by the municipal authorities of Villarroblada (province of Albacete) for the concession for the electric lighting of the town during a period of 10 years.

July 7th.—La Direccion General de Telegrafos in Madrid are inviting tenders for the concession for the establishment and working of a telephone system in the Soria district.

July 17th.—The Spanish Ministry of Public Works in Madrid are inviting tenders for the concession for the construction and working of an electric tramway between Porrino and Vigo (province of Pontevedra).

Stockton-on-Tees.—July 11th. Switches, cut-outs, instruments, &c., for main switchboard, addition to cooling tower, one superheater and one feed water meter, and steam and exhaust pipes and valves for the Corporation. See "Official Notices" to-day.

Swansea.—July 12th. Steam coal for the T.C. Electricity Station.

Swinford.—July 10th. Suction gas plants, engines and dynamos, storage battery, &c., switchboard, overhead lines and street lamps, for the R.D.C. See "Official Notices" June 23rd.

Tunbridge Wells.—The Borough Electrical Engineer is to prepare a specification and obtain tenders for lighting the Royal Victoria and Grosvenor Schools by electricity.

West Ham.—Tenders are to be invited for the following plant in connection with the generating station:—Water-tube boilers, coal-handling plant, turbo-alternator, river service pipework, &c., also for buildings and converter for the Stratford sub-station.

CLOSED.

Ashton-under-Lyne.—The Corporation Electricity Department has accepted the tender of the Bastian Meter Co. for supplying 10-ampere meters for the ensuing year.

Belgium.—A large number of Belgian and German firms submitted tenders last week to the municipal authorities of Ixelles, a suburb of Brussels, for the supply of high-tension three-phase feeders and the telephone cables required in connection with the electricity supply undertaking. The lowest tender for the feeders was that of the Siemens-Schuckert Co., and for the telephone cables that of the Ateliers de Construction Electrique, of Charleroi.

Canada.—According to the *Canadian Engineer*, the following contracts have been given out by Melville (Sask.):—

Kilmer, Pullen & Burnham, of Toronto, agents for the General Electric Co., of Sweden, for generators, switchboards, exciters, pumps, motors and compressors, $7,438.

Northern Electrical and Manufacturing Co., Ltd., Winnipeg, for street lighting system, $832; poles and line material, $2,947.

(*Continued on page* 1047.)

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THE ABERDARE ELECTRICITY AND DESTRUCTOR WORKS.

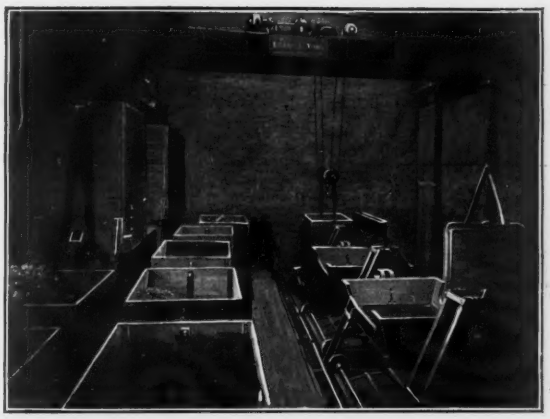
THE Electricity and Destructor Works of the Aberdare Council were opened on March 31st, 1911, by Councillor Thomas Lewis, J.P., Chairman of the Council. Mr. Stephen Sellon acted as consulting engineer for the electrical portion of the scheme, while the destructor was put down by Mr. Owen Williams, surveyor to the Council.

The Council obtained the sanction of the L.G.B. to borrow the money necessary in 1909, and the work was commenced in May, 1910.

The generating plant consists of two Belliss engines coupled to Lancashire interpolar dynamos of 200 and 100 KW. capacity respectively.

There are also installed a booster and balancer by the Lancashire Dynamo Co.; the former consists of two 10-KW. dynamos coupled direct to a 30-B.H.P. motor, the output of each dynamo being 100 amperes at 10-100 volts, 900 R.P.M., and the latter consists of two 25-KW. machines rated at 100 amperes, 230-250 volts, at 750 R.P.M.; there is also a Tudor battery with a capacity of 54 amperes for 10 hours. The switchboard is by the B.T.-H. Co., and consists of 10 polished slate panels; the mains, feeder pillars and the first 100 services were installed by Messrs. Callender's Cable Co.

The street lights are switched "on" and "off" from feeder pillars by Venner time switches; high-candle-power Osram lamps are used instead of arc lamps, and each of the small ts carries 50-C.P. Osram ps. The street ting and ser- e cables are o and three- ore (armoured cables laid direct in the ground.



DESTRUCTOR CELLS, ABERDARE: ONE CELL BEING CHARGED.

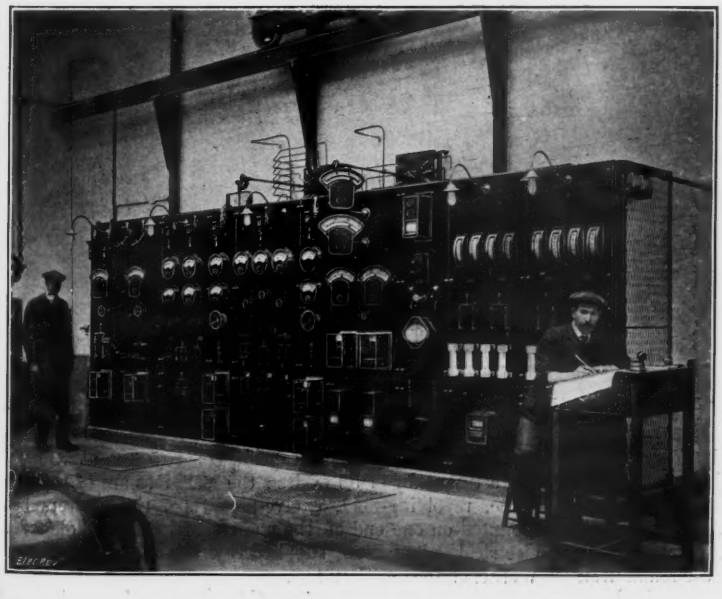
INTERIOR OF ENGINE ROOM, ABERDARE ELECTRICITY WORKS.

Two Babcock marine-type boilers are installed in the boiler house, each capable of evaporating 12,000 lb. of water per hour, and arranged to be fired by coal or from the refuse destructor. The boiler steam pressure is 200 lb., which is reduced to 150 lb. for the main engines; each boiler is fitted with a superheater.

In the pump house are installed two Weir feed pumps, a Roots blower driven by a 33-H.P. motor, and a motor-driven centrifugal pump to deliver river water to a water softener situated above the tanks. The air supplied by the blower to the destructor cells is heated in a regenerator situated in the flue.

The destructor is by the Horsfall Co., and consists of four of their patent tub-feed furnaces, capable of destroying 1 ton of refuse per hour. No test has yet been carried out, but the destructor is guaranteed to evaporate 1·75 lb. of water for every lb. of refuse burned. The steam is to be maintained at 180 lb. pressure per sq. in. with a maximum variation up to 200 lb. or down to 160 lb. per sq. in. A 3-ton Broadbent electric crane is provided in the destructor house, and an overhead clinker railway carries the clinker from the cells to the mortar mill and crushing plant, which are installed outside the destructor house.

Mr. A. J. Abraham, who was clerk of works under Mr. Stephen Sellon, has since been appointed engineer and manager of the electricity and destructor works.



MAIN SWITCHBOARD, ABERDARE ELECTRICITY WORKS.

A VENEZUELAN ELECTRIC LIGHT AND POWER STATION.

THE PLANT OF THE VALENCIA ELECTRICITY CO.

THE accompanying illustrations give views of a small but interesting generating station, which was completed about 18 months ago, to supply Valencia, an important town in the

HYDRO-ELECTRIC STATION OF THE VALENCIA ELECTRICITY CO., VENEZUELA.

coffee-growing district of Venezuela, with electrical energy for lighting and power purposes. A small steam-operated plant was established in the town as far back as 1890, by the International Thomson-Houston Electric Co., which worked it until 1904; it was then acquired and carried on by Messrs. Stelling & Co., a well-known local concern which, in addition to supplying current for private lighting, also had the concession for the public lighting. Although the old plant had given very satisfactory results, it had, owing to the heavy and increasing cost of fuel, long been the intention to substitute for it a new one utilising water power, and with the object of carrying the project into effect the Compania Anonima Electricidad de Valencia was formed in July, 1908, the new company acquiring Messrs. Stelling's plant and interests.

A long period was devoted to the selection of the most suitable site for the location of the power plant, careful observation and measurement showing that at the one finally chosen at Aguacatal, about 9 miles from Valencia, the water supply never falls, even in the driest season, below 40 to 44 gallons per second, while in the wet period the supply rises to over 100 gallons per second. The first engineering work to be undertaken was the building of a dam across the river on which the falls exist. The dam, which is built of concrete, is 45 ft. in length, 13 ft. wide at the foundation, 7 ft. at the top, and 7 ft. high. It is furnished with a circular iron sluice gate, arranged to be operated from a distance by hand and screw gear, and intended to ensure cleanliness of the intake, which is situated at a height of 2,624 ft. above sea level. To the left of the dam is a cemented canal, 120 ft. long, 3 ft. wide, and $2\frac{1}{2}$ ft. deep, which conveys the water to the pipe line, a second sluice gate being provided in it to permit of the regulation of the water as it enters; there is also an intercepting pit and a lateral sluice gate to prevent the collection of any refuse or sand in the canal, and to allow all residue to escape at will.

The pipe line is 5,216 ft., or nearly a mile in length, and has a fall of approximately 1 in 5·8, the intake being at an elevation of 900 ft. above the generating station. The line is constructed of lap-welded steel pipes, 13 ft. long, the first section at the intake end being $\frac{1}{4}$-in. thick, and 21 in. in diameter. The pipes in the second section are of similar thickness, but the diameter is only 18 in. The last two sections are 0·375 in. thick, and of 16 in. and 14 in. diameter respectively. Altogether there are 400 pipes in the line, and as each one had to be separately carted out by mules over very indifferent roads, the operation was a somewhat costly one. A steel cable ropeway had also to be erected to convey the pipes to their respective positions, while a great deal of levelling work had to be undertaken owing to the undulating and broken character of the ground over which the pipe line runs. At every curve the pipes were anchored to large blocks of concrete, and where large openings and streams were encountered, pipes of greater thickness were employed and special flange connections introduced. A stop valve and two cleaning valves, operated from the power station, are provided in connection with the last pipe on the line.

The generating station, which is situated on one side of the river, is a substantially-constructed building 86 ft. long × 40 ft. in width. As will be seen from one of the pictures, only two sets of turbines and generators have so far been installed, but space is available for a third, which will probably be on order by the time these lines are in print. The turbines, which were built by Messrs. Escher Wyss and Co., of Zurich, are each of 250 H.P., and run at a speed of 500 R.P.M.; they are connected by Zodel couplings to

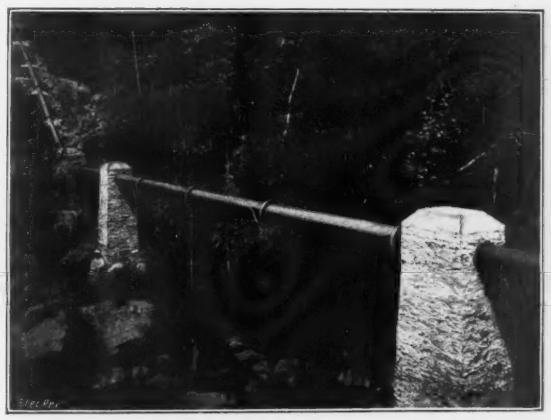
INTERIOR OF TURBINE ROOM, SHOWING ESCHER WYSS TURBINES AND SIEMENS-SCHUCKERT GENERATORS.

generators which have a capacity of 225 KW. at 500 volts, and a frequency of 50 cycles; the machines are of the three-phase, revolving-field, twelve-pole type, the exciters being mounted on one end of the main shaft. The whole of the electrical plant was supplied by the Siemens-Schuckert Werke, of Berlin, Germany.

The transmission line from the power station at Aguacatal to the sub-station in Valencia is approximately 10 miles

long; the wires used are B. & S. No. 4, and are carried on 30-ft. iron poles, the latter being also used to support the telephone wires which connect the plant with the distributing station in Valencia. The current is transmitted at 20,000 volts, and is first transformed at the reception station to 2,300 volts and later to 110 volts, the plant at the transformer station comprising three oil-cooled transformers, one of which is kept in reserve.

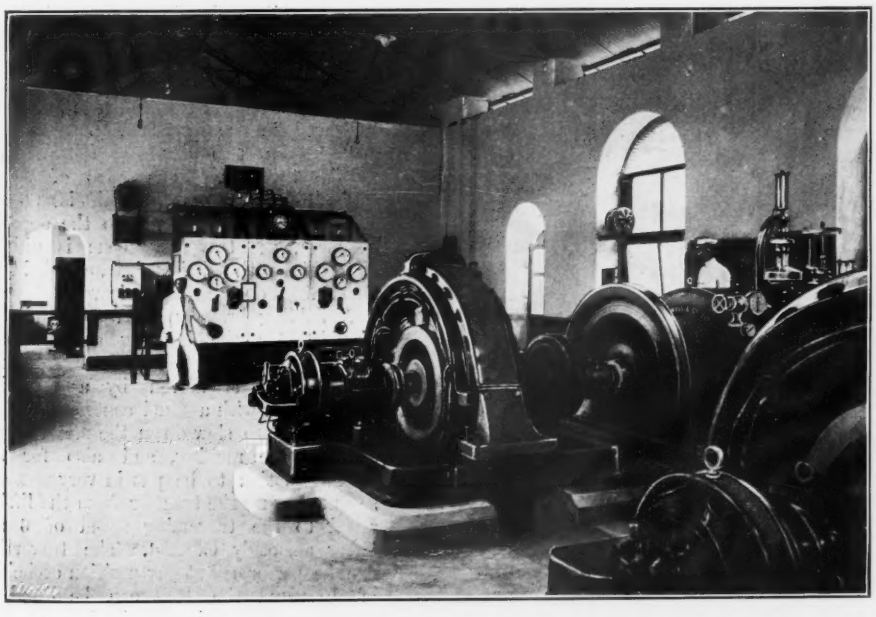
On the completion of the new station, the old steam-operated generating plant was shut down; it is, however, in good condition and ready for any emergency. At the present time, the company is supplying current for lighting purposes to about 100 arc and 1,200 incandescent lamps, and for power purposes to five 50-H.P. motors in a cotton mill, to a 60-H.P. and a 15-H.P. motor in an oil mill, and to a few small motors in a local tannery, corn mill, &c. That the plant has proved successful may be judged from the fact that the first year's working enabled a dividend at the rate of 12 per cent. to be paid, after making full allowance for depreciation and reserve.



Hydro-Electric Pipe Line, Valencia Electricity Co. (p. 1044).

30-CWT. "BARRY" PATENT ELECTRIC TRANSPORTERS FOR JAPAN.

Six 30-cwt. electric transporters, one of which is illustrated on the following page, have just recently been constructed by Messrs. Stothert & Pitt, Ltd., of Bath, for installation at the Japanese port of Keelung. Each transporter is capable of dealing with loads up to 1½ tons at an out-reach of 45 ft. from the centre line of runway track, and has a clear height under the runway beams of 40 ft. from the rail level. The machine runs on rails set to a gauge of 14 ft. centre to centre of rails. The framing is built up of rolled steel sections, rigidly braced together to give ample stiffness, and is so proportioned as to give stability under all conditions of working. The cantilever boom is hinged at a point 12 ft. 6 in. from the centre line of the machine, so that the boom can be lifted up against its stop, to clear shipping coming alongside the quay. The lower portion of the tower of the truck is provided with a hinged platform, and is so designed as to admit of the passage of cars. It is constructed of chequer plates, and capable of carrying a distributed load of 15 tons.



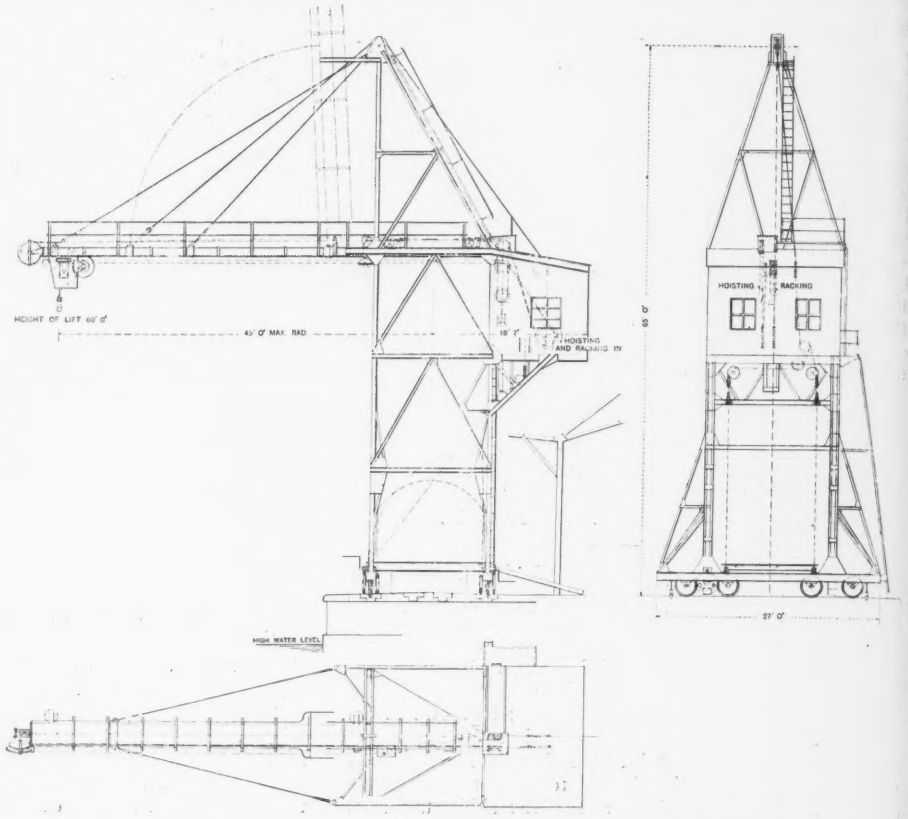
Valencia Electricity Co.'s Station, showing Switchgear, Generators, &c. (p. 1044).

The special feature of these six transporters is the use which has been made of the "Barry" patent gear, the salient feature of which apparatus is that it is unnecessary to lift up to the full height before commencing to traverse the load, as the traversing can be performed at any given height of lift. A further advantage is that the lifting and traversing speeds can be made different, so that a moderate and convenient speed of lift can be adopted, while at the same time the traversing speed can be made very high. This enables a quick travelling speed to be attained, while keeping the lifting speed within a practicable limit. These transporters have a lifting speed of 200 ft. per minute, which is about as fast a speed as a stevedore can deal with cargo. The racking speed can, however, be made up from 0 up to 1,000 ft., the speed being at the rate of 1,200 ft. per minute. The machinery for working the transporter, which is fixed on cantilevers at the back end of the tower, consists of the gearing for lifting and traversing the load, for raising the front portion of the cantilever or boom, and also for raising the hinged platform at the base of the machine. Independent barrels are provided for hoisting the hinged beam and platform, and driving rope pulleys for the lifting and traversing motions. The whole of the machine runs upon eight cast-steel wheels, four in each sill, and is geared so that the machine can be travelled by hand, sets of gearing being fitted one at each side of the truck, opposite one another.

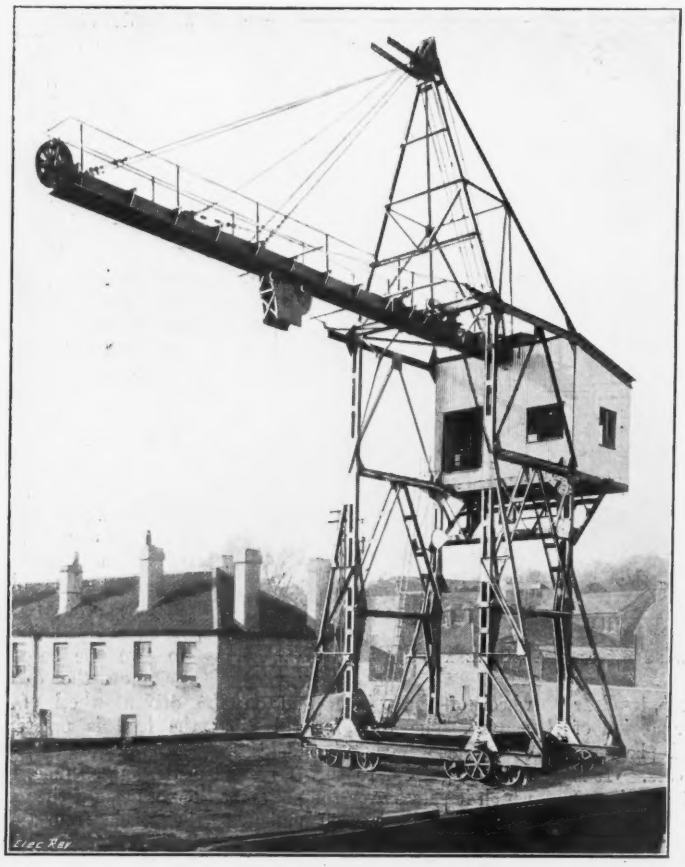
The lifting and traversing motions are effected by a jenny running on four cast-steel wheels on the boom of the cantilever. The rope actuating the lifting is endless and spliced, and is kept under a light but definite tension by a weight, the tension being only sufficient to give the necessary grip on the driving wheel of the winch, and on the driven wheel of the jenny. The rope for travelling the load is practically endless also, because both ends are secured in the jenny, one end being fixed to the front end of the jenny frame, from which it passes over the pulley at the nose end of the cantilever, then by lead-off pulleys to the winch, from thence round the pulleys of the tension device, returning to the jenny, and is finally coiled round a small drum, which actuates the storage drum of the lifting chain. The

machinery for driving the lifting and traversing motions is self-contained on a bed, and consists of fleeting drums round which the ropes are wrapped. The lifting motion is connected direct to the motor by spur gear, and the racking or traversing motion to the lifting gear by a friction cone device. The driving drums are situated side by side, and are so designed that the drive is transferred from one to the other without shock. The two wheels when clutched together revolve as one, and the carriage travels in either direction carrying the load. If, however, the traversing rope wheel is held still (by means of the braking device) and the other wheel revolves, the load will be lifted or lowered.

The traversing braking device consists of wood blocks secured to a circular plate cast to the sliding sleeve, the sliding sleeve being feathered in a pedestal to prevent twisting. Driven by the sleeve is a disk made to bear upon a nest of springs, which are heavy enough to give the necessary frictional resistance to hold the jenny when hoisting, and when put further into gear by the hand lever to couple the driving pulley for racking. The pressure on the adjustable collar of the disk is taken by a "Hoffman" ball bearing. The end thrust on the lifting or traversing shaft transmitted by the driving cones is taken by a ball bearing. The lever for the lifting and traversing gear works as follows: When it is moved in one direction, the cone disk couples the two drums, so that they revolve together. The ratio of speed, without slip, of traverse over lift is as 6 : 1. When the lever is moved in the opposite direction, the traversing cone is disconnected from the lifting cone, and held by a cone fixed on the sliding sleeve.



Views Showing Arrangement of Stothert & Pitt Transporters for Japan.



30-cwt. Electric Transporter for Japan.

A holding brake with foot treadle is provided for the hoisting gear, also a solenoid brake in case of the current failing.

The gear is driven by a reversing motor fitted with a speed controller. Care is necessary to slow down the motor before starting the racking, and also for the racking motion to be put in very steadily, so as to ensure the transfer from the lifting speed to the traversing speed of 6 : 1 being smoothly effected. The traversing can be performed at any position of height of lift, and the load can be lifted or lowered at any point in the boom. The change of motions from lifting to traversing, or *vice versa*, can be performed at any moment. A plain hook is used on the lifting chain without pear weight, as a weight is not necessary to overhaul the machinery or ropes. The jenny is built up of steel plates and angles, rigidly braced together, and runs on four cast-steel wheels keyed to axles revolving in bearings on the jenny frame. The jenny contains the lifting cup drum,

pulley and storage drum suitable for $\frac{9}{16}$-in. chain. The storage drum contains a sufficient amount of chain for a total height of lift of, say, 60 ft. The cup drum is connected to the bevel spur and the rope pulley is connected to the bevel pinion, the ratio of gear between the rope-driven pulley and the cup drum being 6 : 1. The lower portion of the jenny is provided with a cast-steel chain guide, so fitted that it will be impossible for the chain to get across or twist. The motor is of the 25-B.H.P. enclosed ventilated type, suitable for three-phase current, 60 cycles at 200 volts, and is complete with reversible controller and metallic resistances. A switch with fuses, pilot lamp, &c., is supplied in the driver's cabin, where also are a number of incandescent lamps.

Two cargo lamps are provided on the jib, one at the nose end and one near the inner end. The winding drums of the beam and platform motions are put in and out of gear by clutches. Included amongst the equipment is 100 ft. of armoured cable, with fittings for attachment to a plug box on the ground. The house over the driver's cabin is composed of galvanised corrugated sheeting, supported on steel framing, and fitted with the necessary windows and doors.

All shafts are of steel, accurately machined, and the bearings and pulleys are bushed with gun-metal, and have efficient means of lubrication.

OUR LEGAL QUERY COLUMN.

[Questions addressed to this column should be written on one side of the paper only.]

"Special Tools" inquires:—"I should be glad if you would enlighten me as to whether a customer is entitled 'by law' to the special tools used by a firm on his work, even though he has paid the firm to construct them. I have an idea of reading a law case in one of my old Electrical Reviews, where the judge held that he was not entitled to them, as it would be disclosing a trade secret."

*** It is difficult to see how by the mere contract to do work, or to sell goods, any implication could arise by which the customer could claim the special tools. If A asks B to make him a special booster for x pounds, or for such sum as may be reasonable, and B finds it necessary to construct a special tool wherewith to make part of the booster, there is no rule of law which says that that tool shall belong to A, even though the price charged is so great as to necessarily involve A in the entire expense of the tool.

CONTRACTS CLOSED.

(*Continued from page* 1042.)

Australia.—The placing of the following contracts by the Commonwealth Authorities for Victoria is recorded in the *Australian Mining Standard*:—

John Danks & Son Proprietary, Ltd.—cast iron piping, bends, &c., £256.
W. T. Henley's Telegraph Works Co., Ltd.—Telephone cable, £1,569.
Holden & Lewis.—800 covers and frames for manholes, sleeves, bends, &c., £1,393.

The same journal states that the Eaglehawk Borough Council (V.) has placed the following orders:—

R. Hornsby & Son, Ltd.—Suction gas engine, £1,118.
Australian Metal Co., Ltd.—Dynamo and booster, £260.
Pfaff, Pinschof & Co.—Switchboard and apparatus, £128.
Haes & Eggers, Ltd.—E.P.S. storage battery, £530.

For the New South Wales Public Works Committee for the supply of electrical fittings and supplies, for one or two years, "the schedule was split up and divided amongst the lowest two tenderers for the different classes of goods as follows:—Union Electric Co., of Australia, Siemens Brothers, the British General Electric Co, W. T. Henley's Telegraph Co., W. G. Watson & Co., Ltd., Edison and Swan U.E.L. Co., Ltd., India-Rubber & Gutta-Percha Co., (Silvertown), Noyes Bros., Ltd., and Lawrence & Hansen Electric Co."

South Australia.—State Supply and Tender Board:—

James Martin & Co.—200 pairs switches, with switch-boxes and knobs, for £6,996.
Gray Bros.—200 pairs switches, with switch-boxes and knobs, for £7,200.

Bradford.—The Corporation Tramways Committee has accepted the offer of Hurst, Nelson & Co., Ltd., to supply for 12 months' free trial, one of the swing bolster trucks of the type recently adopted by the L.C.C.

Eccles.—The T.C. has accepted the tender of Messrs. S. Hooley & Sons for 5,000 tons of slack for the electricity works.

Dundee.—The Electricity Committee has placed the contracts for the erection of a sub-station at Downfield, at a cost of £500. The Committee also accepted the offer of Mr. T. C. Keay for a new installation of electric light at Lochee Baths.

Erith.—The U.D.C. has accepted the tenders of Messrs. H. W. Clarke & Co., of Erith, and Messrs. Beadle Bros. for coal (wharf screenings) for the electricity works, the former at 12s. 3d. per ton, and the latter at 11s. 3d.

Gloucester.—The following tenders for the supply of mains and distributing pillars have been recommended to the City Council for acceptance:—

*6 concentric armoured feeder cable.—Siemens Bros. & Co.
*4, *1 and pilot cables; also six-way distribution pillars for three-wire system.—British Insulated & Helsby Cables, Ltd.

Government Contracts.—The following tenders have been accepted during the past month by the Government departments named:—

Admiralty, Contract Department.

Circuit-breakers, &c.—Whipp & Bourne.
Gutta-percha.—Craigpark Electric Cable Co., Ltd.

War Office.

Electric cable.—British Insulated and Helsby Cables, Ltd.; Hooper's Telegraph and India-Rubber Works, Ltd.; India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.; Midland Electric Wire Co., Ltd.; Siemens Bros. & Co., Ltd.; Ward & Goldstone; Western Electric Co., Ltd.
Electric incandescent lamps.—Crysselco, Ltd.; the "Z" Electric Lamp Manufacturing Co., Ltd.
Electric motors.—Electric Construction Co., Ltd.

India Office, Store Department.

Dynamos.—J. Stone & Co.

General Post Office.

Telephonic apparatus, flexible cords.—British Insulated and Helsby Cables, Ltd.; London Electric Wire Co. and Smiths, Ltd.
Indicators.—British Insulated and Helsby Cables, Ltd.
Plugs.—British L. M. Ericsson Manufacturing Co., Ltd.
Bell receivers.—Western Electric Co., Ltd.
Branch exchange C.B. switchboards.—British Insulated and Helsby Cables, Ltd.; Western Electric Co., Ltd.
Wall trunk and local switchboards.—British Insulated and Helsby Cables, Ltd.
Telephones.—British L. M. Ericsson Manufacturing Co., Ltd.
P.C. cable.—British Insulated and Helsby Cables, Ltd.; Johnson and Phillips, Ltd.; Siemens Bros. & Co., Ltd.
To provide, deliver and lay submarine cables.—Siemens Bros. & Co., Ltd.
Veering cable.—Telegraph Construction and Maintenance Co., Ltd.
Distributing cases.—British Insulated and Helsby Cables, Ltd.; Siemens Bros. & Co., Ltd.
Insulators.—Taylor, Tunnicliff & Co., Ltd.
Bronze wire.—T. Bolton & Sons, Ltd.; British Insulated and Helsby Cables, Ltd.; Shropshire Iron Co., Ltd.; F. Smith & Co., &c., Ltd.
Flameproof wire.—J. C. Fuller & Son; London Electric Wire Co. and Smiths, Ltd.
G.I. strand wire.—Rylands Bros., Ltd.
Local telephone exchange equipment at Barry (Glam.), Ilford, Nelson (Lancs.) and Rotherham.—The Peel-Conner Telephone Works, Ltd.
Extension local telephone exchange at Mayfair, W.—Western Electric Co., Ltd.

London.—Stepney.—The B.C. received the following tenders for meters up to and including a capacity of 10 amperes:—

Simplex Conduits, Ltd. (no sample submitted)	£139
Bastian Meter Co., Ltd. (does not comply with specification)	152
Reason Manufacturing Co., Ltd. (recommended)	181
Bat Meter Co., Ltd.	184
Geipel, W., & Co.	185
Siemens Bros. Dynamo Works, Ltd.	194
British Westinghouse Co., Ltd.	225
British Thomson-Houston Co., Ltd.	272
Ferranti, Ltd.	302
Chamberlain & Hookham, Ltd. (per Venner & Co.)	302
General Electric Co., Ltd.	376

For meters above a capacity of 10 amperes the tenders were:—

Geipel, W., & Co. (incomplete; no sample)	£77
British Westinghouse Co., Ltd. (no sample)	208
Bat Meter Co., Ltd. (does not comply)	254
Reason Manufacturing Co., Ltd. (electrolytic)	284
British Thomson-Houston Co., Ltd. (recommended)	311
Simplex Conduits, Ltd.	313
Siemens Bros. Dynamo Works, Ltd.	320
Ferranti, Ltd.	346
Chamberlain & Hookham, Ltd. (per Venner & Co.)	346
General Electric Co., Ltd.	354

For demand indicators tenders were received thus:—

Chamberlain & Hookham, Ltd. (per Venner & Co.)	£221
Reason Manufacturing Co., Ltd. (recommended)	418
General Electric Co., Ltd.	1,712

For time switches up to and including 25 amperes capacity:—

Reason Manufacturing Co., Ltd. (recommended)	£275
Venner Time Switches, Ltd.	480
General Electric Co., Ltd. ("Venner" switch)	450
Geipel, W., & Co.	532

Time switches above a capacity of 25 amperes:—

Geipel, W., & Co. (incomplete; no sample)	£43
Venner Time Switches Ltd. (recommended)	88
General Electric Co., Ltd. ("Venner" switch)	88
Reason Manufacturing Co., Ltd.	103

For carbons:—

Geipel, W., & Co. ("Henrion" carbons) (cheaper quality)	£721
" (best quality) (recommended)	811
Electrocarbon, A. G.	873
Webster, C. W. (Compania Fabrik de Carbones Electricos, Barcelona)	956
Ship Carbons, Ltd.	959
Brush Electrical Engineering Co., Ltd.	980
Electrical Co., Ltd	1,000
Gilbert Arc Lamp Co., Ltd.	1,081
Sloan Electrical Co., Ltd.	1,066
General Electric Co., Ltd.	1,110
Globe Electric Co., Ltd.	1,121
Union Electric Co., Ltd.	1,123
Crompton & Co., Ltd.	1,153
Siemens Bros. Dynamo Works, Ltd. (Gebrüder Siemens and Co., Berlin)	1,250
Brault, G.	No tender received
Hayman & Co.	" "

For the provision of steam pipe covering at Limehouse Station, namely :—

Bowden & Co.	(recommended) £63
Turner Bros., Ltd. (inquiry forwarded by Turners & Manville	Quote per foot. Total £98 (estimated)
Hobdell, Way & Co.	£124
Leroy & Co.	128
Thermo Insulation and Engineers' Supply Co.	(No tender) .
Toope's Asbestos Covering Co., Ltd.	„ „

FULHAM.—The B.C. has accepted the tender of A. Emanuel an Sons, Ltd., to supply, at £70, display fittings, radiators, &c., for the showroom at 603, Fulham Road.

HORNSEY.—The B.C. has accepted the tender of Messrs. Babcock and Wilcox, at £2,324, for the supply and erection of a water-tube boiler, automatic stoker, piping, &c., at the electricity works. Three tenders were received.

L.C.C.—The tender has been accepted of Messrs. Dick, Kerr & Co., Ltd., at £2,093 for overhead electrical equipment for tramways from Brixton to Herne Hill, also the tender of Mr. H. L. Holloway, at £1,818, for the erection of workshops, store, &c., at the Stockwell electricity sub-station.

Mansfield.—The T.C. has accepted the tender of Mr. Bertram Thomas for switchgear, at £116.

Milnrow.—The contract for the permanent way in connection with the tramways extension has been let to Mr. Law, of Kidderminster.

Mirfield.—The U.D.C. has accepted the tender of Messrs. Mather & Platt, Ltd., of Manchester, for electric pumping plant.

Radcliffe.—The U.D.C. has accepted the tender of Mr. G. Longfield Beasley for the installation of the Gamewell system of electric fire alarms at £410.

Roodepoort (South Africa).—Electricity is to be supplied by the Victoria Falls Power Co. The following tenders were received for laying down the necessary distributing plant in the town :—

	Fittings.	Poles.	Meters.	Total.
British Westinghouse Co. ..	—	—	£477	—
British Electric Co.	—	—	358	—
*Union Electric Co.	£683	£6,193	605	£7,482
A.E.G. Electric Co.	710	6,280	605	7,432
R. H. Gould & Co.	1,006	7,157	626	8,790
Stewarts & Lloyds	—	258	—	—
H. Davis & Co.	726	7,131	521	8,378
Siemens, Ltd.	883	6,761	318	7,962
Rintoul & Davis	928	—	626	—

* Recommended for fittings and poles.

The meter tenders were left over for further information to be obtained. Mr. de Lacy is consulting engineer.

Rugby.—The U.D.C. has accepted the tender of the British Thomson-Houston Co., Ltd., for a new feeder equipment and re-arrangement of the complete switchboard, at £144.

Southend-on-Sea.—The T.C. has accepted the following tenders for electricity meters :—

Ferranti, Ltd.—3, 5 and 10-ampere sizes.
Venner & Co.—100 5-ampere prepayment meters.

Also that of Messrs. How & Reed, of Southend, for installing the electric light in the two permanent ward blocks in the Sanatorium, at £45.

Stoke-on-Trent.—The Electricity Supply Committee has entered into a contract with the British Westinghouse Co., Ltd., for switchgear, amounting to £6,651, subject to the consent of the L.G.B.

Whitworth.—The Brush Electrical Engineering Co. have received the order for 10 new cars for the Whitworth and Bacup service and for a new street watering car.

Worcester.—The T.C. has accepted the tender of the Electric Construction Co., Ltd., for a 200-KW. motor-generator, at £640 ; and that of the Phœnix Dynamo Co., for a 125-KW. alternator, at £250.

FORTHCOMING EVENTS.

Physical Society.—Friday, June 30th. At 5 p.m. At the Imperial College of Science. Papers "On the Effect of a Narrow Saw-cut in the Edge of a Conducting Strip on the Stream Lines in the Strip and on the Resistance of the Strip," by Prof. C. H. Lees; "The Capacity Coefficients of Spherical Electrodes," by Dr. A. Russell; and "Exhibition of the Benkö Primary Battery," by Mr. W. R. Cooper.

Electrical Contractors' Association (Inc.).—Monday, July 3rd. At 7 p.m. At Frascati's. Annual Dinner.

National Electrical Manufacturers' Association (Inc.).—Wednesday, July 5th. At 3 p.m. Special general meeting at the Institution of Electrical Engineers.

Wednesday, July 5th.—At 12 noon. Council meeting of the Association at the same place.

Thursday, July 6th.—At 2.30 p.m. Council meeting of the Association at the offices, Balfour House, E.C.

Institution of Electrical Engineers.—July 6th. At 9 p.m. At the Natural History Museum, Cromwell Road, S.W. Annual conversazione.

THE ELECTRICAL ENGINEERS (LONDON DIVISION).

THE following orders are issued :—

Commanding Officer—COL. H. M. LEAF.

Friday, June 30th.—"D" Company. Technical drill, 7 to 10 p.m.
Saturday, July 1st.—Felixstowe detachment, parade at headquarters at 1 p.m. Dress :—Service dress, drill order. Arms will be drawn at headquarters before the parade.

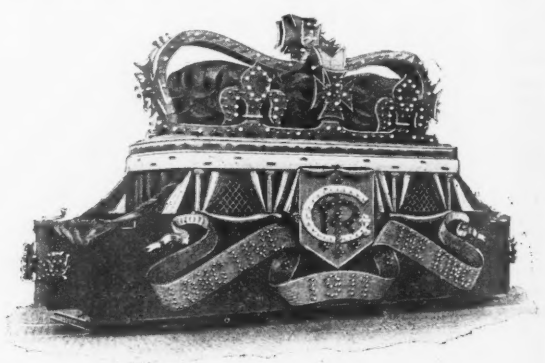
Orders for the week ending July 8th, 1911 :—

Headquarters will be closed for instruction during the week.
Saturday, July 8th.—The Plymouth detachment will parade at headquarters at 9.30 a.m. Dress :—Service dress, drill order, with waterbottle and haversack. Arms will be drawn before this parade.

(Signed) P. H. CAMPBELL, Capt. R.E., Adjutant, L.E.E.

NOTES.

Illuminated Tramcars at Bradford.—The Bradford Corporation tramways department had a couple of illuminated cars touring the routes during the Coronation festivities. The arrangement of these cars (one of which will be seen in the accompanying illustration) was intended to symbolise a crown upon a pedestal, the crown proper being in gold bronze suitably lined. The crown band was perforated, and behind were fixed coloured celluloids and lamps representing jewels; on one side of the car was a ribbon with a ground work of royal blue, and the words "Long Live the King—1911," in bright gold, picked out with gold-coloured lamps also a shield in gold, bearing the monogram "G.R.I." in white, red and blue lamps respectively. A ribbon on the opposite side of



the car carries the words "God Save the Queen—1911," and a gold shield with the monogram "M," in white. The whole of the devices on the car were picked out with suitably coloured lamps there being in all 1,050 lamps used in the illumination of each car. The total height to the top of the Maltese cross was 16 ft., and the effect when the car was lighted was extremely brilliant. This device was considered the finest of its kind that had ever been seen in the city, and it met with universal admiration. The whole of the work of designing and preparing the cars was executed by the tramways department.

Parliamentary.—GERMAN RAILWAY ELECTRIFICATION.—In the Parliamentary papers recently, Mr. Chiozza Money asked the Prime Minister if his attention had been directed to the fact that German producers already possessed the advantage of cheaper railway rates than were available here; that Germany was entering upon a vigorous policy of railway electrification; and that electrification would give in addition to still lower railway rates, cheap supplies of light, heat, and power for industrial and social purposes; and if in view of the increasing handicap which British producers and traders would soon suffer in these respects, he could say whether the question of railway nationalisation was engaging the attention of the Government. The Prime Minister, in reply, stated that he understood that railway rates were to some extent lower in Germany than in this country, but it was difficult to make an effective comparison. Steps were, he believed, being taken to equip portions of the German railways for electrical traction, but a cheap supply of electrical power did not necessarily depend on the electrical equipment of railways. He was unable to promise legislation with a view to railway nationalisation.

MERCHANDISE MARKS ACT.—Mr. Lloyd recently asked the President of the Board of Trade whether he was aware that a large quantity of goods made abroad entered this country without any mark of origin, and were subsequently marked with the names of British importing houses; and whether, seeing that this practice was a practical evasion of the Merchandise Marks Act, he would take steps to render obscurity of origin impossible. Mr. Tennant, in reply, said that he was aware of the practice referred to, but

there was nothing in the Merchandise Marks Act which prevented a trader or dealer so marking his name on foreign-made goods, and so long as the goods were not made to bear a false indication of the country where they were produced, or a false trade description, he did not see how the practice could be regarded as an evasion of the Act.

Fatality.—The death took place at Burnley Hospital, on June 22nd, of John Clague, of Halstead Street. Deceased was a wireman in the employ of Burnley Corporation Tramways Department, and he was engaged, with other men, in repairing overhead wires, when a portable furnace lamp, which burst, set fire to his clothing with fatal results. An inquest concerning the fatality was held on Friday last, when Mr. H. Mozley (tramways manager), and Mr. Starkie (electrical engineer), were both present. Albert Clague, an overhead lineman, brother of the deceased, said the lamp had not worked well that particular morning. Deceased was badly burnt about the arms and legs. For some reason the pipe had become choked. The outbreak was so fierce that some of the oil spurted on a building near by and set fire to it. A verdict of "Accidental death" was returned by the jury.

The Publicity Committee and the Olympia Exhibition.—The Stepney Electricity Committee has recently had under consideration a communication from the Hon. Secretary of the Associated Municipal Electrical Engineers (Greater London), dated May 22nd, 1911, intimating that the Joint Publicity Committee has under consideration the question of the provision of an Information Bureau at the above-named Exhibition. The London Electric Supply Companies have made themselves responsible for a suitable stand, and the total expenditure will amount to £1,000. Of this amount the companies are contributing one-half, and, having regard to the interest which local authorities owning electricity supply undertakings have in such a matter, it is considered that the remaining sum of £500 should be subscribed by them. It is accordingly suggested that this sum of £500 should be contributed by municipalities upon the basis of the size of their undertakings by contributions varying from £10 to £30. This would, in the case of the Stepney undertaking, be £30. The Information Bureau or Stand will be so arranged that it will on one side contain a room for a proper exhibit of publicity matter, and on the other a meeting room to be utilised for lectures and demonstrations on any point that is not satisfactorily met by the general exhibit. Each of the local authorities taking part will be allowed to circularise its consumers that a representative from it will on certain days be present to give full information, and any inquiries from persons living in each of the areas of the local authorities participating will be communicated from the Bureau. The Stepney Committee reports that having regard to the benefit likely to accrue in this matter, it has decided to participate in the proposal upon the basis of a contribution of £30 to be paid out of the funds of the undertaking.

Science Examinations.—In a circular (No. 776) just issued the Board of Education announces that, in accordance with notices previously circulated, an extensive reorganisation of the system under which science examinations are held will come into force in 1912. No further examinations of Stage 1 Standard will be held, but examinations of superior standard for students in evening and other part-time classes will be continued; practical examinations will be abolished, and certain subjects will be dropped. In future there will be two stages only, designated "Lower" and "Higher" respectively; special examinations will be held to determine the awards of Royal Scholarships and Free Studentships in Science, and of Whitworth Scholarships and Exhibitions. Students taking full-time courses will not as a rule be eligible for the Board's examinations, and teaching institutions will be encouraged to hold their own examinations for such and to grant diplomas to successful candidates. Under the Grouped-Course system certificates and diplomas will be issued attesting the satisfactory completion of well-balanced courses of study, which will, on certain conditions, be endorsed by the Board, and will, it is hoped, become recognised as having at least a definite minimum value; the Board will discontinue the issue of separate personal certificates of success in its own examinations. An appendix to the circular gives particulars of the groups and subjects in which the Board will in future hold examinations, the conditions of admission, the regulations for the endorsement of diplomas, &c., and other necessary information.

Institution and Lecture Notes.—The Faraday Society.—The following nominations for the officers and Council (1911-1912), to be elected at the annual general meeting on July 11th, have been made by the Council:—President: Dr. R. T. Glazebrook, F.R.S.; Vice-Presidents: G. T. Beilby, S. Z. de Ferranti, F. W. Harbord, Prof. B. Hopkinson, A. Siemens, Ernest Solvay, Prof. J. Walker. Treasurer: F. Mollwo Perkin. Council: E. J. Bevan, Dr. H. Borns, W. R. Bousfield, W. R. Cooper, Dr. J. A. Harker, Prof. A. K. Huntington, Dr. T. M. Lowry, R. L. Mond, Dr. G. Senter, M. Solomon.

A lecture on "Modern Methods in Telephony" was delivered recently by Mr. John Lee, traffic manager of the telephone department of the G.P.O., London, at Trinity College, Dublin.

Appointment Vacant.— Electrical tester, for H.M. Dockyard, Devonport (45s.). See our advertisement pages to-day.

I.C.S. Convention.—A great gathering of students of the International Correspondence Schools, of Kingsway, took place recently in London; they assembled at the Festival of Empire at the Crystal Palace, and were addressed by Sir Joseph Ward and other prominent men, Lord Desborough, president of the London Chamber of Commerce, being in the chair. A special I.C.S. song was written for the occasion, and a luncheon party followed the demonstration. We are informed that the I.C.S. now have 37,650 students in Great Britain alone, and 130,000 in other parts of the Empire—truly a gigantic *clientèle*.

Annual Outing.—The Linolite Co.'s annual outing was held on Saturday, June 24th, the party consisting of the works and office staffs, Mr. Ackermann (engineer and manager), Mr. R. L. Matthews (assistant manager), and Mrs. Ackermann being present. The party started early from the offices in Victoria Street, in a four-horse brake, reaching Chertsea on Thames in due course. Luncheon and tea were served in picnic fashion at St. Anne's Hill, by permission of Sir Albert Kaye Rollit, LL.D., who very kindly conducted the party round his grounds, and over his handsome Georgian residence, pointing out many interesting features, and showing numerous international decorations and presentations which he had received. After a late tea the party drove back to London *via* Staines, Hounslow, and Hammersmith, having spent a most enjoyable day.

Legal.—Cavehill and Whitewell Tramway.—In the King's Bench Division, Dublin, last week, judgment was given in the matter of the Corporation of Belfast *v.* the Cavehill and Whitewell Tramway Co., which was argued before the Lord Chief Baron, Mr. Justice Kenny, and Mr. Justice Wright, on an application by the Corporation to set aside the award of Mr. Macassey, the arbitrator appointed to settle the amount of the purchase money to be paid by the plaintiffs for the defendant company's undertaking The Lord Chief Baron, in delivering judgment, said the application raised questions in respect of an award which amounted to a very large sum (£58,000), but these questions presented no difficulty in his mind so far as determining the motion before them. The only question which the Court had really to determine was what was the basis on which this award was made—was it a true basis? He was perfectly clear that this award was based wrongly. He was also of opinion that there was jurisdiction in that Court to set aside the award. They had decided to set aside the award or remit it to the arbitrators. That was a matter in which they would hear counsel at a subsequent stage. The arbitrator, appointed under the provisions of the Belfast Corporation Act of 1910, was to settle the value of the undertaking as mentioned in the statement, and having regard to all the circumstances, the Court had arrived at the conclusion that he had proceeded upon a wrong basis in deciding the valuation. He quite understood how this lamentable difficulty arose; it was owing to the state of the law in the country, as different to the law in England, in reference to arbitration. Having regard to the enormous expense that had been incurred, he thought the award ought to be remitted to the arbitrator for reconsideration and redetermination. This was eventually done.

The Telephone Transfer.—The following letter has come to hand while we are going to press:—

"With reference to the leading article on 'The Telephone Transfer' in your issue of June 16th, and to the letter signed by Mr. Herbert Laws Webb in your issue of the 23rd inst., I do not think it of any use to continue the correspondence on so contentious a subject.

"The enclosed cutting from the *Financial Times* of June 21st is a reply to Mr. Webb's criticism, and I am entirely in accord with the writer of the letter.

"The decision of the House of Commons on the 19th inst. has settled the final issue, and no newspaper correspondence can now influence the movement to the contrary.

"As regards my remarks at the recent meeting of the Peel-Conner Telephone Works, Ltd., I can only repeat that they were due to a desire on the part of the shareholders of the company to have my opinion on this question, which has been so widely discussed by various sections of the Press. If my frank and honest statement incurred so much public comment and your adverse criticism, I can only regret it, but I can in no way change my views.

"Peel-Conner Telephone Works, Ltd.
"H. Hirst, *Chairman*."

International Electrotechnical Commission.—In conformity with the wishes of the Brussels Conference held in August, 1910, the delegates of the British, French and German Electrotechnical Committees met at Cologne in the middle of May last, and accomplished very excellent work.

Prof. Eric Gerard having presided at the Brussels Conference, at which the subject of nomenclature had been much discussed, was specially invited to attend, so that not only was there a continuity of ideas, but the delegates were entirely free to put forward their particular views. Those present were:—Prof. Eric Gerard, president of the Belgian Committee; M. E. Brunswick, delegate of the French Committee; Dr. E. Budde (president of the German Committee; Dr. Silvanus Thompson (delegate of the British Committee); and Mr. C. le Maistre, general secretary of the Commission.

Before the actual work of the meeting was commenced, a most important suggestion was outlined by Dr. Budde dealing with the international unification of symbols. On behalf of the German-speaking nation, as represented by the Elektrotechnischer Verein of Berlin, Dr. Budde said that they would be prepared to abandon the use of W for resistance and adopt R, if the English-speaking nations, on the other hand, would adopt I instead of C for current. Dr. Budde was quite ready to exclude J as a synonym for I owing to

the confusion which would arise due to the fact that J is already employed to represent other quantities. Dr. Thompson, on behalf of the British Committee, willingly concurred in this suggestion, and as the American Institute already employs I, and through the good offices of the American Electrotechnical Committee, the National Electric Light Association of America is being approached in the matter, there is every hope that at Turin the symbols I, E, R will be universally adopted. Such a decision, if ratified by the Commission, as no doubt it will be, will certainly be a most encouraging step in the right direction.

The discussion of the work of the various committees on the German list of terms put forward at Brussels was then entered upon, and a list of some 50 industrial terms and definitions was agreed to in French and English. The word "industrial" has been introduced so as to distinguish this work from that of the vocabularies in course of preparation by several of the committees, the reason being that the vocabularies include definitions of a character more abstract and general and more rigidly scientific than is necessary in the case of industrial terms, which are more conventional, and can therefore be defined in less academic language, and yet prove of inestimable value to the industry by facilitating commercial transactions between buyer and seller. As the time at their disposal was so limited, the delegates intend to meet again at Turin early in September so as to have an opportunity of revising their work before submitting it to the plenary meeting. In the meantime the work already carried out is being issued to the various committees for their consideration.

Special mention must be made of the work of the Danish Committee, which was presented in such an admirable manner, and has been of very considerable assistance to the Committees generally. The work of the Japanese, the Mexican and the Spanish Committees was also most complete.

The small Committee has been so successful in its task that in all probability the appointment of other small International Committees, to study certain particular subjects in a preparatory manner, will be considered in the near future, and thus work will be going on continuously and more rapid progress ensured.

The Telephone Appeal: Result. — In the Second Appeal Court on Wednesday morning, the Postmaster-General's appeal was allowed, with costs, and the cross-appeal of the National Telephone Company was dismissed, with costs.

Turin International Congress for the Applications of Electricity.—The following have been appointed as delegates to represent the Institution of Electrical Engineers at the Congress which is to be held in Turin in September, 1911:—Mr. S. Z. de Ferranti, Colonel R. E. Crompton, C.B., Mr. W. Duddell, F.R.S., Dr. R. T. Glazebrook, C.B., F.R.S., Mr. R. Kaye Gray, Mr. R. Hammond, Major W. A. J. O'Meara, C.M.G., Mr. A. Siemens, and Dr. S. P. Thompson, F.R.S.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—MR. R. BAKER, of the Wimbledon electricity supply works, has been appointed charge engineer at Taunton, to succeed MR. T. J. CONSIDINE, who has been appointed charge engineer at Limerick.

MR. W. DUNDAS, who has resigned his position as senior charge engineer at the Metropolitan Railway Co.'s power station, Neasden, in order to take up the post of charge engineer in Stuart Street electricity works, Manchester, has been presented with a silver tea and coffee service by the electrical engineering staff of the Metropolitan Railway Co.

On Wednesday, 21st inst., at the Croydon electricity works, MR. FRANK TRELIVING was presented with a handsome electroplate tea tray, by the staff and employés of the department, on the occasion of his marriage and departure for Australia.

MR. MATTHEW MARSHALL, assistant engineer-on-watch at the generating station of the Lancashire Electric Power Co., Radcliffe, Lancs., has been appointed charge engineer to the Bombay Electric Supply and Tramway Co., Ltd., at a salary of 325 Rs. per month.

The marriage took place at Stowell Church, Salford, on June 19th, of MR. MATTHEW SHAW, electrical engineer, of Manchester, and Miss Elizabeth Williams, third daughter of Mr. Williams, New Tredegar.

On Monday, June 26th, at the Ealing Town Council electricity works, the staff of the electricity department presented a handsome watch to MR. RICHARD GOLDING (shift engineer) on the occasion of his leaving Ealing to take up a position in Australia. The borough electrical engineer (Mr. J. D. Knight) in making the presentation, testified to the very valuable services which Mr. Golding had rendered at Ealing. In response, Mr. Golding thanked the borough electrical engineer and staff, and expressed his regret at leaving the Ealing electricity works after having been there for the past five years, and he hoped that he would get on as well with his future chief and colleagues as he has done with those at Ealing. A hearty vote of thanks to the borough electrical engineer was proposed by Mr. A. E. Pullen (assistant chief engineer).

Tramway Officials.—The Exeter City Council have, by 16 votes to 10, declined to pass a recommendation of the Tramway Committee to increase the salary of MR. BARTLETT, tramways manager, from £160 to £170 per annum, and the matter was postponed. A member said it was an insult to offer Mr. Bartlett £10; if he was entitled to more salary, he should receive at least another £50 a year.

General.—MR. A. W. EMPSON, of the Cast-Iron Brazing Syndicate, Calcutta, has recently been elected a Fellow of the Chemical Society.

Owing to increased business and increasing prosperity, the Clyde Valley Electrical Power Co. has reorganised its staff, and the following changes and reappointments have taken place:—MR. D. A. STARR remains as general manager of the company, and MR. R. ROBERTSON, who has held the post of secretary for several years, now becomes commercial manager, and has charge of the selling and development department. MR. H. E. FERGUSON, who has held the position of chief accountant for several years, has been appointed secretary. MR. D. MACFARLANE MACLEOD is the resident engineer, and MR. W. G. CRAWFORD is mains superintendent.

MR. JOHN WM. PENICUD, who was lately works manager to Messrs. Sanger, Shepherd & Co., Ltd., of London, has now joined the foreign staff of the Morgan Crucible Co., Ltd., as sales engineer attached to their Paris branch.

The Council of the National Electrical Manufacturers' Association have elected MR. F. H. NALDER to the post of chairman, as, in consequence of MR. W. H. BUTLER having, for a time, severed his connection with the electrical manufacturing industry, he has resigned the chairmanship of the Council, and his resignation the Council accepted with much regret.

MR. G. D. MATHEWS has left the Government service at the Royal Arsenal, Woolwich, and has joined the staff of the Tudor Accumulator Co., Ltd., London.

The Council of the Royal Society of Arts have awarded a silver medal to Prof. Raoul Pictet for a paper read during the past session on "Les Basses Températures."

Obituary.—MR. P. S. SHEARDOWN.—We record with deep regret that Mr. Percy Sewell Sheardown died on Monday, 19th inst., as the result of an accident. He was 42 years of age, and was about to be married. His presence will be very much missed amongst the Dublin electrical engineers, as he has been identified with the tramway company since the lines were first electrified. Mr. Sheardown was educated at a private school near Dublin, at a school in England, and at the Finsbury Technical College. He went straight from college to the Dublin United Tramways, where he served for some time under the immediate command of Mr. Towle, who placed him in a position of responsibility in what was then the Clontarf power station. From this he worked up to the position of chief electrical engineer to the company, and filled it with great ability and success. He was blest with the quality of caution, and although he was always well on a level with the times, he weighed all new propositions very carefully before committing himself to a favourable report. The condition of the power station at Ringsend, the erection of which he superintended for the consulting engineer, was always a striking testimonial to his fitness for his position, and it is well known that the results which have been obtained from this station are among the best. In addition to Mr. Sheardown's professional work, he was very active in philanthropic and religious matters. He took a very considerable part in the organisation of the Social Service League in Dublin, and he was a leading member in the Leeson Park Congregation. For several years past Mr. Sheardown was a lecturer at Trinity College on Electric Traction, and his combination of theory with the best practice made him an invaluable teacher. Within the last few years he was selected by the President of the Institution of Electrical Engineers as Arbitrator in a dispute between a firm of electrical contractors and a district council, and his conduct of that case indicated clearly his powers of balanced judgment. He had filled the office of chairman of the loca section of the I.E.E.

The death occurred on June 22nd of MR. HENRY HATCHETT, of Wolverhampton, who was for many years secretary of the South Staffs. Tramway Co., Darlaston.

CITY NOTES.

India-Rubber, Gutta-Percha and Telegraph Works, Ltd.

THE half-yearly meeting of the shareholders of this company was held on Tuesday at the offices, 106, Cannon Street, E.C., Major Darwin in the chair.

The CHAIRMAN said that at that half-yearly meeting there were no accounts or report, the proceedings usually being limited to a statement from the chair and the payment of an interim dividend. He regretted that on the present occasion circumstances should lead the directors to believe that while declaring the full half-yearly dividend on the preference shares, they should not make an

interim distribution to the holders of ordinary shares. It was true that it had been their habit to make this half-yearly payment, but the condition of the market for raw material was absolutely abnormal during the first six months of the financial year, and the board had thought it incumbent upon them to depart from the usual practice in this respect. As an illustration of the markets they had had to deal with, he might mention that during the 31 days of October last the price of the highest grade of Para rubber varied between 5s. 10d. and 7s. 1d. per pound. Again, at the end of December it was quoted at 5s. 6d., while in the early days of March it rose to 7s. 2d. They would not fail to understand from that how difficult it was for the board to say with certainty, in the absence of a complete stock-taking, whether or not there was a profit to divide out of the half-year's earnings. In considering the situation one had to take into account the fact that the extraordinarily high price of raw material which ruled during the last six months of their past financial year inevitably left them at the commencement of this year with a stock at a value very difficult to realise on a generally falling market. He might remind them that last year during the gambling in raw rubber which then prevailed, the highest grade of fine Para was sold at 12s. 6d. per lb. The leading American technical journal, in its issue of the 1st inst., said, "It sounds paradoxical, but rubber manufacturers dread a sudden drop in the price of crude rubber just as much as they do an advance. Take, for example, the late break. Manufacturers here and abroad had millions of dollars' worth of goods made up for the spring and summer. These goods were made of crude rubber, for which they paid a high price. When the market went off, however, they were forced by customers, and by competition, to take much less for them than if no such drop had taken place." That was an expression of American opinion which he thought worth submitting to them. It was to be hoped that, in the interest of the manufacturer, the fall in prices might become less rapid, so that stocks might be realised at a profit. One, however, always had to face the probability that even existing prices would not be maintained, because the truth was that ordinary production and consumption did not in any way justify them. The board could not but be pleased at one effect of the high price of robber, and that was the encouragement given to planters. There was no rose without its thorn, and, unfortunately for rubber manufacturers, the thorns at present predominated The amount of business which the company had done had been quite satisfactory, and the board thought that their worst troubles were over; the principal anxiety that remained being the possibility of obtaining remunerative prices for the stock in hand, and in process of manufacture. To this, particular attention was being paid in the hope that the financial year as a whole would show the results which they all desired. Their sales of goods into the composition of which rubber did not enter, were quite normal, and appreciably better than was the case this time last year. He could only reiterate the regret of the board that an interim dividend should be withheld from the ordinary shareholders on the present occasion for the reasons he had stated.

A resolution was agreed to sanctioning the payment on July 1st of an interim dividend of 5s. per share, less income-tax, on the preference shares.

Elektricitäts Gesellschaft vorm. W. Lahmeyer & Co.

THE report of the directors of this Frankfort company for 1910-11 covers the period during which the majority of the shares were transferred to the Zurich Bank for Electrical Enterprises in exchange for shares in the latter, the transfer comprising about £1,050,000 out of a total ordinary capital of £1,250,000. In addition the Lahmeyer company disposed of Felten & Guilleaume-Carlswerk shares of £175,000, which were exchanged with the bank for shares in other electrical enterprises, whilst the sale of further shares of £25,000 in the Carlswerk leaves the Frankfort company still in possession of £600,000 in F.-G. shares. Apart from the Schonheide central station, which is the only works still held on lease, the works owned by the Lahmeyer company are now valued at £284,000, and the shares and other investments in numerous undertakings are booked at £2,312,000, as compared with £2,271,000 in 1909-10. The accounts show gross profits of £179,000 in 1910-11, as against £152,000 in the previous year. The provision made for depreciation of the company's own works has been very considerably increased, and amounts to £45,000, whereas only £8,300 was set aside for this purpose in 1909-10, £9,700 in 1908-9, and £9,400 in 1907-8. After meeting the interest payments on the bond capital of £1,088,000, the net profits and balance forward are returned at £65,000, as compared with £72,000 in 1909-10, and the dividend is at the rate of 4 per cent., thus showing a further decline, seeing that 5 per cent. was paid in 1909-10, 6 per cent. in 1908-9, and 7 per cent. in each of the three preceding years.

Companies Struck off the Register.—The following companies have been struck off the register and are accordingly dissolved:—

A.E.C. Carburetter Co., Ltd.
Eaton Telephone Disinfector Co., Ltd.
Electro-Brass Co., Ltd.
Garonne Valley Electric Supply Co., Ltd.
Turbinal Tubeless Boiler Syndicate, Ltd.

National Electric Supply Co., Ltd.—The directors have declared an interim dividend of 3s. per share, less income-tax, on the ordinary shares for the half-year to June 30th.

Thames Ironworks, Shipbuilding and Engineering Co., Ltd.—In their report for the past year the directors state that the company has had a satisfactory year's work. The tide of industrial depression, so far as the Thames Iron Works is concerned, has now turned, and the prospects point to a recurrence of more prosperous years. The directors, however, have decided to declare no profits for the present year, on account of H.M.S. *Thunderer*, H.M.S. *Chatham*, and other large current contracts, as, although they have every reason to anticipate that such profits have been already earned, it is wiser to deal with facts rather than estimates, and to regard the whole question of anticipated profits from the most conservative point of view.

Electrometallurgy in Switzerland.—The Société Anonyme Electrometallurgique Paul Girod, of Neuchatel, is unable to pay any dividend for 1910, this having been also the case in the previous year. The annual report, which states that several other electrometallurgical companies likewise experienced unfavourable results in 1910, shows that the value of the turnover advanced from £200,000 in 1909 to £320,000 last year, but notwithstanding the efforts made to reduce the expenses, the year's profits only amounted to £2,600, owing to the decline in the prices of alloys. It had also to be taken into consideration that the factory at St. Gervais, which was valued at £200,000 in the balance-sheet, was only in operation for five months. There was, however, no reason to doubt the future of the company. On the contrary, the reduction in prices had brought about a limitation of the production and more normal prices. The Compagnie des Forges et Aciéries Electriques Paul Girod, which had not yet reached the stage of being remunerative, had required funds, and the Neuchatel Company had sanctioned them in the form of a loan of £320,000, which had been concluded with a group of French and Swiss banks. The Compagnie des Forges had received a large order from the French Government for the supply of shells, the delivery having first commenced in 1911. At the recent meeting of the Neuchatel Company authority was given for the repurchase of the water-power and works of Doron de Beaufort, belonging to the Société Electrometallurgique Sud-Est, which was principally engaged in the production of aluminium, the price being paid in the form of annuities during 35 years.

Marconi International Marine Communication Co., Ltd.—The directors' report for the year ending December 31st, 1910, states that last year they had the satisfaction of announcing that the company's business had then reached the stage when the revenue exceeded the somewhat heavy expenditure necessary for the establishment of a business of this nature, and expressed their confidence that the business would continue to show considerable extension. This forecast has been substantially realised. At the end of 1909 the company possessed and worked 143 telegraph stations on board ships on the high seas. On December 31st, 1910, this number had been increased to 250, and at this date there are 303 such telegraph stations at work. The profit for the past year, after allowing for the debenture interest, amounts to £10,765, leaving to the credit of profit and loss account at the end of 1910 £15,321. The directors recommend the payment of a dividend for the year ending 1910 at the rate of 5 per cent., which will absorb the sum of £10,203, leaving a balance of £5,118 to be carried forward. Since the last general meeting, Mr. Godfrey C. Isaacs has been appointed managing director of the company, Commendatore G. Marconi, LL.D., D.Sc., &c., having resigned that position. The retiring directors are Commendatore G. Marconi and Mr. Alfonso Marconi, who, being eligible, offer themselves for re-election. Attached to the report is a lengthy list of vessels other than warships, fitted with the Marconi system

Belgian Investments in Russia.—A further increase in Belgian electrical investments in Russia has just taken place by the transfer of shares held by the German Electrical Enterprises Co. (Gesellschaft fur Elektrische Unternehmungen) of Berlin to a new Belgian company which has been formed by the Société Générale Belge d'Enterprises Electriques and the Société Financiére de Transport et Enterprises Electriques. The Russian undertakings concerned are the Riga electric tramway system and the Bialystok electricity works, and the German company held shares of £172,425 in the former and £118,000 in the latter. In addition to the disposal of these shares the Berlin company is transferring shares of £26,400 in the A.E.G. Union Co. of Vienna to the Belgian company, which has a share capital of £400,000, but the first-mentioned company continues its Russian interests in the Kieff electricity works.

Eastern Extension, Australasia and China Telegraph Co., Ltd.—The directors have declared an interim dividend for the quarter ended March 31st, of 2s. 6d. per share, free of income-tax.

Rio de Janeiro Tramway, Light and Power Co., Ltd.—The directors have declared a dividend of 1¼ per cent. on the issued capital stock.

Vulcan Boiler and General Insurance Co.—The *Times* reports an interim dividend of 9 per cent. actual, as compared with 8 per cent. a year ago.

Continental Notes. — FRANCE. — La Compagnie Francaise des Cables Telegraphiques, of Paris, reports a net profit of £17,111 for the last financial year, as compared with £25,436 in the preceding 12 months. No dividend is being declared.

BELGIUM.—La Societe d'Electricite du Brabant, of Oisquerq, is increasing its capital to £80,000.

Globe Telegraph and Trust Co., Ltd.

THE directors' report for the year ended May 31st, 1911, states that the net revenue, after deduction of expenses, amounts to £211,859, and makes, with the balance of £27,681 brought forward, a total of £239,540. From this amount there has been distributed £131,085 in interim dividends, leaving an available balance of £108,454. The directors now recommend the payment of the following final dividends, viz., 3s. per share, less income-tax, on the preference shares, making with previous distributions a total dividend for the year on those shares at the rate of 6 per cent. per annum, less income-tax; and 6s. per share net on the ordinary shares, making, with previous distributions, a dividend on these shares at the rate of 6 per cent. net for the year. These dividends will absorb £79,922, and leave a balance of £28,532 to be carried forward During the year £37,200 Anglo-American Telegraph Co.'s preferred stock, and 600 shares of £20 each in the Direct United States Cable Co. have been sold; and the proceeds have been invested in shares of the Mackay Companies.

The meeting of this company was held on Tuesday at Electra House, E.C., the Marquis of Tweeddale presiding.

The CHAIRMAN, in proposing the adoption of the report, said it was the best they had ever been able to present to the shareholders during the 38 years of the company's existence; and it was all the more satisfactory when they remembered that last year's report was an improvement upon the preceding year. At the same time it must be remembered that dividends in the companies in which they were interested were liable to fluctuations, so that it was impossible to foresee the changes that might take place, and which might, as a result, affect the dividends which it was their business to distribute. The receipts for the 12 months, after deducting the usual working expenses, amounted to £211,858 as against £209,117 in the preceding year, showing an increase of £2,741. They had already distributed three quarterly interim dividends of 2s. per share to the ordinary shareholders, and also three interim dividends at a fixed rate of 6 per cent., less tax, to the preference shareholders. Those distributions had absorbed £131,085, and the directors now recommended the payment of a final dividend of 6 per cent. as against 5⅞ per cent. last year on the ordinary shares. The amount required for this dividend, together with that of a final dividend of 3s. per share on the preference shares, absorbed £79,992, leaving a balance of £28,532 to be carried forward. That satisfactory result was largely due to the increased dividend which they had received from the Telegraph Construction and Maintenance Co. In the previous year their dividend was increased from 15 to 17½ per cent., while in the past year they had made a further increase to 20 per cent. Whether that dividend was likely to be maintained or not it was impossible to say, but in the meantime the shareholders might congratulate themselves on so handsome a return upon their investment. Turning to the changes which had taken place in the securities of the company during the year, they had continued their policy of making a re-distribution of some of the investments. As he pointed out last year, the effect of those changes had been to increase their investments in some of the best telegraph companies in which their holdings were rather small, while some of the larger holdings had been correspondingly reduced, making the distribution of their capital more equal. In pursuance of that policy they had sold £37,200 Anglo-American Telegraph Co.'s preferred stock, and had reinvested the proceeds in common shares of the Mackay Co. As regarded the negotiations which had been proceeding for some time between the Anglo-American Telegraph Co. and the Western Union Telegraph Co., it was stated in the financial papers that a provisional agreement had been signed between those companies subject to the approval of the shareholders. Whether that was the case or not, it was certain that before any scheme was decided upon it would be subject to ratification by the shareholders of the two companies, and when that time arrived they might rest assured that their interests in the Anglo-American Co. would not be lost sight of. They had disposed of 600 of the old shares of the Direct United States Co. of the nominal value of £20 each, the proceeds of which had also been reinvested in the Mackay common shares. In regard to the dividends shown in the report as having been received from that company, it was necessary to explain that some of them were from shares which had been sold, so that although the return per cent. per annum was not quite so high as appeared in the report, it was considerably better than in the previous year, inasmuch as they had this year received 5 per cent. as against 4¼ in the previous period. Those shares were now quoted as £10 shares instead of £20 as formerly, the alteration having been made for the convenience of investors, and he thought it had been an advantage. During the year they had purchased an additional 2,550 common shares of the Mackay Co., the bulk of them having been purchased with the proceeds of the sales of the shares to which he had already referred. That company paid 5 per cent. on those shares, and the return they got was more than was shown in the report, inasmuch as on some of the shares recently purchased they had not received a full year's dividend. On May 4th a drawing took place for certificates in the Submarine Cables Trust, and several which were held by them were drawn for payment at £120 per certificate. The drawing realised £840, and that money also had been invested in the common shares of the Mackay Co., while coupons of reversion had been placed amongst the company's securities, and should some day be of considerable value. There was a slight increase in their receipts from the Western Union Telegraph Co., due to the fact that in the early part of the preceding year they had purchased an additional 450 shares, and in last year's accounts they only had a six months' dividend on them. This year they had received the full amount of interest. He was glad to be able to say that the valuation of their securities showed that the increase over cost price was £494,130, or £124,000 better than it was at this time last year.

SIR JAMES PENDER, Bart., seconded the motion.

MR. WOODMAN called attention to the item of £414,234 in the balance-sheet as differences on securities realised and deficiency on capital issued for acquisition of securities. He said that that item disfigured the balance-sheet, and he would suggest that it could be got rid of if the investments were taken at the market price, the appreciation over cost price to be carried to a reserve account, which should be specifically labelled so that it was never likely to be treated as revenue. If the directors could not see their way to do that, he would suggest that the market price of the investments might be stated in the balance-sheet as a note, so that the figures might be included in the certificate of the auditors.

The CHAIRMAN said he would promise Mr. Woodman that the board would take his suggestions into consideration, but he did not think it would be at all an easy matter to carry them out, on account of the fluctuations in market prices, and he was not quite sure that the auditors would desire to make any alteration in respect to the way of showing the losses. He did not think it at all necessary that the item should be altered. The shareholders were aware that the £400,000 had been far more than made good, for the figure he mentioned of £494,000 over and above original cost, included that loss of £400,000, so he thought that on the whole they had done very well.

The report was adopted.

Bombay Electric Supply and Tramways Co., Ltd.

THE profit and loss account of this undertaking (which is a subsidiary of the British Electric Traction Co.) for the year ended December 31st, 1910, shows a credit balance of £64,000, which is an improvement upon the previous year's result. This, however, is only attained by capitalising a proportion of the debenture interest, as well as a proportion of London Administration Charges.

With the amount brought forward from 1909, there is an available total of £68,731, of which £35,983 is absorbed by the preference dividend paid and accrued, £15,000 is placed to depreciation account, £6,000 to the debenture redemption fund, and the balance of £11,748 is carried forward.

It is somewhat surprising that the specific amount of debenture interest capitalised is neither stated in the balance-sheet nor in the profit and loss account, and this striking omission should be repaired by the auditors. The debenture interest for the period should be shown in the profit and loss account, less the amount deducted and transferred to capital, and a similar procedure should be followed in regard to London administration expenses. Of course, the capitalisation of debenture interest and administration expenses is not an operation that can be characterised as being good finance, but it is one to which the company is now somewhat accustomed. In 1908, for instance, £2,407 of debenture interest was charged to capital as well as a proportion of London administration and general expenses, and even the interest on a temporary loan was similarly treated.

Of the income yielded by the electricity supply section, viz., £66,000, nearly £30,000 was contributed by the tramway section.

Some explanation (for a tramway company) is required as to the investments standing at cost in the books at £78,396, included in which is £1,289 apparently in its own 5 per cent. second mortgage debentures, and particularly so in view of the fact that since the close of 1910 arrangements have been made for the sale of a further £50,000 5 per cent. second mortgage debentures. The depreciation account stands at only £15,310, which, no doubt, has part of its existence in the investments mentioned.

The cost of underwriting and issuing capital and discounts and commissions on debentures stands at the sum of £157,075, and is, of course, no asset at all. The sundry creditors (excluding accrued debenture interest), are large at £40,000.

It will be remembered that the undertaking was promoted by the British Electric Traction Co., and that the purchase price to that company was £950,000, which was to be satisfied as to—

£225,000	in cash.
£600,000	by the allotment of that amount of 4½ per cent. debenture stock.
£125,000	by the allotment of 12,500 fully paid ordinary shares of £10 each.
£950,000	

It was stated in the prospectus that £656,666 represented the actual expenditure of the B.E.T. in the acquisition of the horse tramway, but this sum was augmented as follows:—

£656,667	purchase money paid to Bombay Tramway Co., Ltd., of which £300,000 "may be considered as payable for goodwill."
£80,000	payments made, or to be made, in respect of electrical works.
£71,294	actual disbursements.
£17,039	estimated further disbursements.
£825,000	

so that the profit of the B.E.T. was in the neighbourhood of £125,000, as between it and the present company. The Electric and General Investment Co., Ltd., underwrote the preference share issue in consideration of the allotment of 14,500 fully paid ordinary shares; 5,500 of these shares going to the B.E.T., who were interested by agreement dated July 13th, 1905, between it

and the Electric and General Investment Co. This £950,000, which includes the profit to the B.E.T. £125,000, goodwill, £300,000, cost of conversion of the horse tramways to electric traction, as well as the sums of debenture interest and general expenses which have been capitalised, are included in the capital expenditure which requires a liberal appropriation for some years of the resources of the revenue account towards effecting a substantial reduction. The horse tramways, which are not now in existence, are stated in the balance-sheet at a balance of cost of £115,342.

A Canadian Amalgamation.

A CANADIAN correspondent states that a merger is in course of negotiation of the Ottawa Electric Railway Co., the Ottawa Light, Heat & Power Co. (which includes the Ottawa Gas Co) and the Ottawa Car Co. A holding company will be formed to take over the existing companies with a capitalisation of $20,000,000—namely, $10,000,000 in 5 per cent. bonds and $10,000,000 in stock.

The Ottawa Electric Co. is capitalised at $500,000 of 4 per cent. bonds and $1,247,000 of paid-up stock. The dividend last year was 10 per cent. with a bonus of 2 per cent., but the net earnings were 22 per cent., and the stock is fairly set down as 300. The Ottawa Light, Heat and Power Co. was formed not long ago by a merger of the Ottawa Electric Co. and the Ottawa Gas Co. The company has no bonds, but has $2,000,000 paid-up stock. Originally the stock was $1,600,000, but recently a bonus of 25 per cent. in stock was issued to the shareholders. The stock sold as high as 16s. in February. Sales have recently been around 15s. 3d. The net earnings last year were 6 per cent. on present capital. The Ottawa Car Co. is capitalised at $200,000. The profits of the company have been good.

The total capitalisation of the three companies, taking the stock at par, is—bonds, $500,000; stock, $3,247,000. The statement is that in the merger to be effected the Railway stock will be turned in at 300, the Light, Heat and Power at 200, and the Car Co. at 250. The necessary issue of securities by the merger at this rate is figured:—

	Bonds.	Stock.
Ottawa Electric Railway	$500,000	$3,741,600
Light, Heat and Power	—	4,000,000
Car Co.	—	500,000
	$500,000	$8,241,000

J. G. White & Co., Ltd.

THE directors' report for the year to February 28th, 1911, says that the results of the business have continued to be satisfactory, with a net profit on the year's trading of £91,466. The prospects for the future are looked upon by the directors as encouraging. Investments are shown in the balance-sheet at what in the directors' opinion is a conservative valuation. The return of interest and dividends on investments during the year was equal to 8·2 per cent. on the amount of the valuation. The "purchase of business" account was written down last year out of profits from £47,975 to £15,000, and this balance of £15,000 the directors recommend should be written off this year. A special dividend equalisation reserve is also established, and £15,000 out of the profits of the year is allocated to this account. The directors recommend an increase of the total dividend rate on both classes of shares to 12 per cent. per annum. This is the maximum dividend to which the preferred shares are entitled. In addition an extra dividend of 10s. per share on the ordinary shares is recommended. The balance to the credit of profit and loss, after bringing in £19,404 from the previous account, deducting the interim dividend paid on the preferred and ordinary shares at January 1st, 1911, and making provision for percentages due to directors and staff, is £88,813. This sum the directors recommend should be dealt with as follows:—A dividend, less income-tax, at the rate of 14 per cent. per annum on the cumulative preferred shares for the half-year to February (making 12 per cent. for the year), £10,500; a dividend, less income-tax, at the rate of 14 per cent. per annum on the ordinary shares for the half-year to February, £3,500: an extra dividend of 10s. per share, less income-tax, on the ordinary share capital for the year, £25,000; in writing off the balance of "Purchase of Business" account, £15,000; to "Special Reserve" (for equalisation of dividends), £15,000; to be carried forward, £19,813.

Aron Electricity Meter, Ltd.

THE meeting of this company was held on Tuesday, June 20th, at Winchester House, E.C., Mr. H. Hirst presiding.

The CHAIRMAN in moving the adoption of the report (see ELECTRICAL REVIEW, p. 973), said he hoped the shareholders had looked at the figures with the same amount of pleasure that they had given to the directors; they showed the healthy development and progress of the business. Comparing this year's report with last year's, he singled out the following items for comment. First, the most interesting item of gross profit on trading amounting to over £44,000. This was nearly £9,000 in advance of last year, and nearly every branch in every country had contributed to this pleasant result. The amount received from dividends on investments was reduced, owing to the fact that the expansion of the business drained their liquid reserves to the utmost previously to their debenture issue. They had to realise these reserves during the year, and, he regretted to say, at a loss. No blame could be attached to the directors for this loss, as they kept those reserves in trust securities, and they were all familiar with the fact that all trust securities in this country had receded in their value to an unpleasant standard. Whatever the causes might be, it was not for them to discuss, but they must realise the fact. He referred to it not only on account of the items on the debit side of the profit and loss account, namely, £78 and £85, but more on account of the fact that they had had on a previous occasion to write trust securities down by an amount of between £700 and £800. On the debit side of the profit and loss account he wished to point out that they had depreciated this year more by about £1,600 than last year, and the additional expenses were due to the recent debenture issue, which necessitated calling in the old debentures, and paying the premium on them. The management charges were, of course, increased, but not out of proportion to the increased business. As regarded the figures on the balance-sheet, on the credit side they had increased stock and outstanding accounts, but the directors were satisfied that the increase was normal in proportion to the increase of business. The large amount of cash at their disposal was, of course, the residue of the recent debenture issue. On the debit side of the balance-sheet he would like to refer to the increased nominal capital. They had not issued any additional capital; they had only asked for the power to do so. This was a necessary provision to meet the possible—he might say probable—desire of the new debenture-holders in due course to avail themselves of their option of converting their debentures into ordinary shares. He was happy that they were at last in a position to pay a dividend to the ordinary shareholders, and he personally thanked them for the patience they had shown. He thought the outlook was such that they might enjoy continued participation in their prosperity. They would continue to be conservative in their policy, and he hoped they approved of their recommendation to put £5,000 to reserve account and use £7,000 of this year's profits in writing off a portion of the costs of the debenture issue. He personally hoped, and thought he was justified in doing so, that the profits they were now making might continue, and that the business they had established might prosper further to enable the directors to distribute in the future satisfactory dividends to both classes of shareholders. As regarded the business itself, there was very little new to say. The meter business was carried on on the same lines as before; their increased output had strengthened their power to compete in the world's markets; their organisation, thanks to the supervision and hard work of Prof. Aron, was being more and more perfected every year, and the loyalty and interest in the business of the staff was an asset of which they could be proud. Concerning the taximeter business, they were pleased with the ever-increasing number of instruments that were being placed on the streets. It might be pleasant news to the shareholders to learn that they had hitherto used the total revenue from this branch of the business towards writing down the expenses and cost of the instruments which they hired out, and none of the revenue had so far been used in arriving at the figure which they recorded as trading profit. By this conservative policy they hoped in years to come to create a valuable annual contribution towards the dividends they hoped to pay.

SIR J. PENDER, Bart., seconded the motion.

The CHAIRMAN, replying to a question, said that the company, recently formed for the better administration of the taximeter business, was practically a subsidiary concern. They held all the shares, and any profits would come to them.

The report was adopted.

The Austrian Siemens-Schuckert Works. — The report for 1910 of the Austrian Siemens-Schuckert Works Co., of Vienna, states that the year was a period of abundant work and satisfactory results. Notwithstanding keen competition and the partial withholding of orders in consequence of the general economic situation, a large augmentation took place in the orders received, and the works were fully employed. The orders comprised 31 electricity works, 2 electric railways, extensions of 50 electricity works and 8 tramways, and many hundreds of installations for lighting and the transmission of power. After allocating 1,211,000 crowns to depreciation in 1910, as compared with 1,101,000 crowns in the previous year, the accounts show net profits of 1,336,000 crowns, as against 1,290,000 crowns in 1909, and a dividend of 6 per cent. has been declared, being the same rate as in the preceding year. At the close of the year the company provided employment for 5,000 officials and workers, or 1,000 in excess of those at the end of 1909. The orders on hand at the beginning of 1911 would occupy the works for a long time forward. At the recent general meeting it was decided to increase the share capital from 18,000,000 crowns to 24,000,000 crowns for the purpose of reducing the floating debt. The Siemens & Halske Co., of Berlin, and the Laender Bank, it was mentioned, had the right of taking over the new shares as a result of former agreements, but they had resolved to exercise the right only to the extent of one-half of the fresh issue, leaving the other half to be offered to the shareholders at the price of 125 per cent.

Shawinigan Water and Power Co.—A dividend of 1¼ per cent. (at the rate of 5 per cent. per annum) for the quarter ending June 30th is payable on July 20th.

Melbourne Tramway and Omnibus Co., Ltd.—A dividend of 4½d. per share for the quarter ending 30th inst. is announced, being at the rate of 15 per cent. per annum.

Hobart Electric Tramway Co., Ltd.—The directors have declared a dividend of 6 per cent., free of income-tax.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight. £	Receipts for the fortnight. £*	No. of wks.	Total to date. £	Total to date. £*	Route miles open.	Inc.
Aberdeen	June 21	2,971	+ 69	3	4,797	+ 260	..	..
Ayr	„ 24	628	— 67	6	1,758	— 58	8	..
Bath	„ 24	1,704	— 85	25	19,337	+ 383	..	..
Belfast	„ 23	9,606	+1,334	12	55,378	+ 7,662	40	3
†Birkenhead	„ 18	1,060	— 74	11	12,848	+ 481	13·68	..
Birmingham Corp.	„ 17	15,001	+1,684	11	81,597	+ 5,569	56·7	..
Blackburn	..	..	..	..	..	..	..	..
Blackpool Corp.	„ 22	2,831	+ 773	..	13,221	+ 2,971	..	..
Blackpool-Fleetw'd	„ 24	1,559	+ 192	25	11,946	+ 664	..	..
†Bolton	„ 18	2,439	— 26	12	29,316	+ 2,331	26	..
Bournemouth	„ 21	8,323	— 21	12	20,604	+ 1,072	21·9	..
Bradford	„ 17	12,578	+1,888	11	62,941	+ 5,294	54·8	..
Brighton	„ 25	2,112	+ 120	12½	12,556	+ 1,145	9·5	..
Bristol	„ 23	13,433	+1,185	..	..	..	..	..
Brit. Elec. Trac. Co.								
Airdrie	„ 16	471	+ 19	24	5,163	— 7	3·65	..
Barnsley	„ 16	401	+ 59	„	4,285	+ 222	..	..
Barrow	„ 16	734	+ 110	„	6,211	+ 389	5·37	..
Cavehill	..	..	..	..	..	..	..	..
Devonport	„ 16	1,158	+ 284	„	10,928	+ 1,156	8·85	..
Gateshead	„ 16	2,210	+ 248	„	24,162	+ 1,344	11·25	..
Gravesend	„ 16	538	+ 103	„	4,706	+ 67	6·5	..
Greenock	„ 16	1,678	+ 196	„	16,125	+ 2,162	7·25	..
Hartlepool	„ 16	710	+ 181	„	5,705	+ 446	6·72	..
Kidderminster	„ 16	401	+ 180	„	2,439	+ 162	..	..
‡Leamington	„ 16	508	+ 147	„	3,600	— 14	..	..
Merthyr	„ 16	542	+ 116	„	4,810	+ 116	2·9	..
Metropolitan	„ 16	21,165	+13,350	„	200,534	+29,449	22	..
Middleton	„ 16	987	+ 265	„	7,776	+ 612	8·5	..
Mid. Joint Com'tee	„ 16	14,477	+2,605	„	139,310	+ 7,788	..	..
Oldham—Ashton	„ 16	1,341	+ 189	„	13,361	+ 488	9·13	..
Peterborough	„ 16	314	+ 87	„	2,678	+ 169	5·31	..
Potteries	„ 16	4,099	+ 673	„	45,771	+ 4,595	29	..
Rothesay	„ 16	199	— 13	„	2,512	— 70	2·75	..
Southport	„ 16	944	+ 307	„	6,599	+ 212	8·17	..
S. Metropolitan	„ 16	2,270	+ 479	„	19,213	+ 475	..	..
Swansea	„ 16	2,722	+ 560	„	26,075	+ 1,758	12·5	..
Tynemouth	„ 16	952	+ 339	„	4,749	+ 283	3·75	..
Weston-s-Mare	„ 16	718	+ 382	„	1,904	+ 135	3	..
‡Worcester	„ 16	807	+ 178	„	6,461	+ 266	5·75	..
Wrexham	„ 16	245	+ 41	„	2,307	+ 47	..	..
Yorks. Wool. Dist.	„ 16	2,365	+ 326	„	24,537	+ 1,685	17	..
Miscellaneous	„ 16	852	+ 133	„	5,086	+ 328	..	..
Burnley	„ 24	2,794	+ 266	..	..	..	11·73	1
Burton-on-Trent	„ 11	633	+ 94	10	2,830	+ 120	6·6	..
Bury	„ 18	2,759	+ 261	11½	14,694	+ 1,117	22·5	..
Cardiff	„ 10	6,339	+1,831	10	25,408	+ 2,788	..	..
Chatham and Dist.	„ 15	2,037	+ 224	24	19,239	+ 27	14·98	..
Cork	„ 23	1,073	— 6	25	11,868	+ 164	9·89	..
†Croydon	„ 9	2,440	+ 695	..	18,732	+ 1,459	..	..
†Darlington	„ 17	214	+ 16	12	2,537	+ 245	..	..
†Darwen	„ 16	864	+ 8	11	3,044	+ 289	4·36	..
Dover	„ 17	863	+ 131	11	2,675	+ 411	4·75	..
Dublin	„ 23	11,884	— 378	..	136,244	+ 4,871	54·5	..
Dundee	„ 21	2,360	— 125	5½	6,407	— 89	15	..
East Ham	„ 24	2,290	+ 106	12	13,491	+ 853	7·87	..
Exeter	„ 23	767	+ 96	12	4,194	+ 348	5·5	..
†Glasgow	„ 17	19,391	+ 338	..	50,359	+ 4,715	98	·75
Hastings	„ 22	2,088	— 8	..	..	..	..	..
Huddersfield	..	..	..	..	..	..	..	..
Hull	„ 17	6,196	+ 739	11	31,563	+ 1,481	14·5	..
Ilkeston	„ 22	239	— 37	12	1,600	— 80	..	..
†Ipswich	„ 7	419	— 8	11	4,295	+ 531	10·5	..
Kilmarnock	„ 17	210	+ 9	4	755	+ 16	4·25	..
Lancashire United	„ 21	2,815	— 87	25	32,480	+ 736	39	..
†Leeds	„ 17	7,087	— 331	11	84,949	+ 7,121	108	..
Leicester	..	..	..	..	..	..	..	..
Leith	„ 24	1,364	+ 34	5½	3,923	+ 242	8·72	..
Liverpool	„ 17	24,750	+1,811	24	269,618	+ 9,992	116	6·5
‡L.C.C.	„ 14	94,671	+8,282	..	479,409	+28,162	139	6·5
†London United	„ 24	15,988	+1,205	..	157,652	+ 4,750	..	..
Lowestoft	..	..	..	..	..	..	3·5	..
†Manchester	„ 17	15,703	— 447	12	183,387	+12,881	183	..
†Newcastle	„ 17	4,037	+ 39	..	45,551	+ 3,458	14·5	..
†Newport	„ 10	964	+ 258	10	7,528	+ 565	14·5	..
†Oldham	„ 5	2,100	+ 324	10	20,303	+ 1,160	23·5	·5
Portsmouth	..	..	..	..	..	..	15·25	..
Preston	„ 21	1,487	..	12	9,465	+ 754	..	..
Salford	„ 19	10,706	+ 707	11½	56,849	+ 3,527	..	..
†Sheffield	„ 20	6,101	+ 71	..	78,188	+ 5,338	40	..
†Southampton	„ 14	1,256	+ 127	11	12,719	+ 1,109	..	..
Southend-on-Sea	„ 21	1,954	+ 72	12	7,314	+ 1,105	..	..
†South Shields	„ 17	581	— 11	10½	6,991	+ 1,059	..	..
Swindon	„ 24	315	+ 20	12	1,837	+ 196	..	..
†Tyneside	„ 14	465	— 40	24	10,490	+ 980	..	..
Wallasey	„ 10	2,679	+ 798	10½	11,457	+ 2,112	..	..
Walthamstow	„ 24	1,696	+ 25	12	9,914	+ 1,024	9	..
West Ham	„ 15	6,114	+ 858	11	80,357	+ 3,430	15·25	..
Wolverhampton	„ 21	1,866	+ 41	12	11,827	+ 1,320	25	..
Cen. London Rly.	„ 17	5,173	— 762	24	124,662	—11,169	6·32	..
City & S. Lon. Rly.	„ 25	7,102	+1,068	25	84,085	+ 3,404	7·26	..
Dublin-Lucan Rly.	„ 23	382	— 2	25	3,228	+ 12	7	..
†G.N. and City Rly.	„ 17	1,428	+ 75	24	33,809	+ 1,488	3·5	..
†L'pool Overh'd Rly.	„ 18	1,457	+ 45	..	34,306	+ 2,060	6·8	4·8
†Llandudno-Col. Bay	„ 16	862	+ 70	28½	5,134	+ 245	..	..
London Elec. Ry. Co.	„ 24	36,625	+11,390	25	357,395	+25,660	21·25	..
Mersey Railway	„ 24	4,161	+ 56	25	51,723	+ 1,120	4·5	..
Metropolitan Rly.	„ 25	88,837	+2,819	..	430,650	+11,214	24·5	..
Met. District Rly.	„ 24	80,016	+7,364	25	299,581	+24,904	24	..
Anglo-Argentine	„ 24	98,945	+6,641	..	1,238,589	+129,810	..	..
§Auckland	„ 2	17,089	+2,289	..	192,840	+20,985	28·8	·6
Bombay (B.E.T.)	May 26	5,612	+ 416	21	60,214	+ 3,232	..	..
Brisbane	May	21,099	+2,609	..	..	..	..	..
Brit. Columbia Rly.	..	..	..	..	..	..	..	..
Calcutta	June 24	7,206	+ 805	..	..	..	..	..
Cape Electric T.Ld.	..	..	..	..	..	..	..	..
§Kalgoorlie, W.A.	May	3,529	..	..	16,815	..	20·5	..
§Lisbon	..	..	..	..	..	..	..	..
Madras	June 16	1,358	+ 105	..	16,750	+ 1,112	..	..
§Montevideo	May	16,817	—5,861	32	182,493	+10,120	..	..
†Perth (W.A.)	June 16	1,508	+ 70	..	39,072	+ 1,949	29	..

* Compared with the corresponding period of 1910. † One week only.
‡ Includes horse, steam and other receipts. § One month.

STOCKS AND SHARES.

Monday Evening.

MARKETS in the Stock Exchange cannot be said even yet to have recovered their normal conditions after the interruption to business caused by the Coronation. Nor can it be said that there has been any special impetus given to trade in the markets for the time being; but, on the other hand, a good many people consider that there will still be an interval between now and the summer holidays during which investment and speculation may wake up to a greater extent than the pessimists prophesy.

The highly elaborate nature of the precautions taken by the police, no doubt, had a good deal to do with the frightening of people from attending the procession in as good numbers as they would otherwise have done. Consequently, traffics may reflect this attitude of caution in some degree. However, the crowds for the illuminations were enormous, in spite of the rain on Friday night, and there is no doubt that this week's figures will make a very presentable showing; but the Home Railway stocks are more under the influence of the possible strike of sailors than any other factor. Why this labour trouble should affect the Undergrounds it is impossible to say, but the fact remains that Metropolitans have fallen away again, being 2¼ lower, Districts are 1¼ down, and the other Tube stocks are not particularly good. So far as the first-named is concerned, it is certain that something of a "bull" account still remains, and this exercises a depressing influence upon the price with the approach of each Stock Exchange settlement.

The shares of the London Electricity Supply Companies are steady and without any special feature beyond that furnished by the recovery in Metropolitan Ordinary and Preference. For some time past, these shares have been particularly weak, and it is time for them to start a revival. The Ordinary have recovered ¼, and the Preference ⅛. St. James' and Pall Mall gained ⅛, and a similar fraction has been added to their prices by Charing Cross Preference, County Preference and Bournemouth Second Preference. South Londons show a trifling decline.

The feature of the moment in the Industrial market is the activity in Marconi shares. By the time that this appears the company's report may be issued. The *Daily Mail's* statement to the effect that it came out last week is, of course, incorrect. Possibly the paper was referring to the report of one of the subsidiaries to the Marconi Company. The shares touched 43s., went back to 40s, and then advanced again, so that on balance they are $\frac{7}{8}$ higher.

Another interesting development in the Telegraph market is the introduction to the Paris Bourse of American Telephone and Telegraph Capital stock. The introduction was not too happily made, however, for on its very day a large American holder sold a line of shares, and, in addition, the directors decided to increase the capital. Consequently, there was friction in Paris from the start, but the Banque de Paris met the situation very fairly by offering to repurchase all the shares that had been sold; and in due course the Bank got a good many of them. After this, however, a fresh rise set in, though a net decline of 3 points remains. The Arbitrageur of London has added the stock to his list of securities which he deals in when he can between London and Paris. The market, nevertheless, is still mainly in New York, and it is America which controls the price of the shares. New York Telephone Bonds are ½ higher. Globe Ordinary receded after their rise on the increase in dividend. In the Eastern group, Eastern Ordinary is ½ up. The Anglo-American division is very quiet. Reuter's continue their steady improvement.

National Telephone speculative issues have fallen again by reason of the Post Office appeal against the decision of the Commissioners in regard to the opening round of the arbitration. The Deferred fell 3, making 6 points during the past fortnight, and the third Preference shares are ½ lower.

Canadian-Mexican descriptions are mainly firm, but there has been another perplexing and disquieting fall of 4 in Northern Light and Power bonds, the explanation of which seems still to be wrapped in mystery. At all events, the dealers declare that they cannot discover any reason for the persistent offering of the stock. On the other hand, Montreal Light and Power capital stock rose no less than 8½, and there is a shortage of supply to meet the demand. Canadian General Common stock has recovered its 2 point loss of last week, and there is no change in Shawinigan on the declaration of the usual dividend. Mexico Trams hardened a little, while Rio Trams went back 1, as did also Sao Paulo Trams. There has been a fall of ⅛ in Madras Electric Supply Ordinary, but Calcutta Trams improved.

In the Home Traction Department there are few attractions. Underground Electric Railways Income Bonds rose a point, and the British Electric Traction varieties have not moved. Farther afield, British Columbia Electric Railway stocks are good, and Bombay Debenture stocks have been wanted, the just-issued report showing a reasonable prospect of a dividend on the Ordinary shares in the near future.

Manufacturing shares are slightly disposed to be easier, with the exception of Aron Ordinary and Electric Constructions, both of which have small gains. The National Electric Supply Company has declared an interim dividend of 3s. per share for the half-year.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1909.	Dividends for 1910.	Closing Quotations June 26th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bournemouth & Poole, Ord.	* 10	5½	5¾	8 — 9	..	6 2 3
Do. 4½ % Pref.	10	4½	4½	9 — 10	..	4 10 0
Do. Second 6 % Pref.	10	6	6	10¾ — 10¾	+ ⅛	5 11 7
Do. 4½ % Deb. Stock	Stock	4½	4½	102 —104	..	4 6 7
Brompton & Kensington, Ord.	5	10	10	8 — 8½	+ ¼	5 17 8
Do. 7 % Cum. Pref.	5	7	7	7⅞ — 8	..	4 7 6
Central Electric Supply, 4 % Guar. Deb.	100	4	4	98 —101	..	3 19 3
Charing Cross, West End & City	5	5	5	3⅞ — 4⅛	..	5 14 3
Do. 4½ % Cum. Pref.	5	4½	4½	4¼ — 5	+ ⅛	4 10 0
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3⅞ — 4⅛	..	5 2 10
Do. Do. 4 % Deb.	100	4	4	94 — 96	..	4 3 4
Chelsea, Ord.	5	4¼	5	4 — 4½	..	5 11 1
Do. 4½ % Deb.	Stock	4½	4½	100 —102	..	4 8 3
City of London, Ord.	10	7	7	11⅜ — 12¼	..	5 14 3
Do. 6 % Cum. Pref.	10	6	6	12 — 13	..	4 10 0
Do. 5 % Deb.	Stock	5	5	121 —125	..	4 0 0
Do. 4½ % Second Deb.	100	4½	4½	101 —104	..	4 0 0
County of Durham, 5 % First Mort. Deb.	Stock	5	5	92 — 94	..	5 6 5
County of London, Ord.	10	5	5	7⅞ — 8⅛	..	6 3 1
Do. 6 % Pref.	10	6	6	11 — 11½	+ ⅛	5 4 4
Do. 4½ % Deb.	Stock	4½	4½	109 —111	..	4 1 10
Do. 4½ % Second Deb.	Stock	4½	4½	99 —102	..	4 8 3
Edmundson's, Ord.	5	Nil	Nil	⅜ — 13/16	..	Nil
Do. 6 % Cum. Pref.	5	Nil	Nil	2½ — 3	..	Nil
Do. 4½ % First Mort. Deb.	100	4½	4½	86 — 89	..	5 1 2
Folkestone	5	5½	6	4¼ — 4⅝	..	6 9 9
Do. 5 % Cum. Pref.	5	5	5	4¼ — 5¼	..	4 15 3
Do. 4½ % First Deb.	100	4½	4½	97 —100	..	4 10 0
Hove	5	8½	9½	6¾ — 7½	..	6 11 0
Kensington & Knightsbridge, Ord	* 5	8	9	7 — 7¾	..	6 2 0
Do. 4 % Deb.	Stock	4	4	93 — 95	..	4 4 3
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	80 — 84	..	5 7 2
London Electric, Ord.	3	2	2	1⅜ — 2⅛	..	2 16 5
Do. 6 % Pref.	5	6	6	4¾ — 5⅛	..	5 17 1
Do. 4 % First Mort. Deb.	Stock	4	4	89 — 92	..	4 7 0
Metropolitan	5	5	5	3⅜ — 4⅛	+ ¼	6 1 3
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜ — 4½	+ ⅛	4 12 4
Do. 4½ % First Mort. Deb.	Stock	4½	4½	102 —105	+1	4 5 9
Do. 3½ % Mort. Deb.	Stock	3½	3½	86 — 89	..	3 18 8
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	98 —100	..	4 10 0
Newcastle-on-Tyne	5	4	4	3½ — 4	— ¼	5 0 0
Do. 5 % Pref., Non. Cum.	5	5	5	4 — 4½	..	5 11 1
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	99 —102	..	4 18 0
Notting Hill	10	7⅜	8	12 — 12⅞	..	6 5 6
Oxford	5	7	7½	6⅛ — 6⅝	..	5 9 5
St. James' and Pall Mall, Ord.	5	10	10	8⅞ — 9⅛	+ ⅛	5 6 8
Do. 7 % Pref.	5	7	7	6⅞ — 7¼	..	4 16 7
Do. 3½ % Deb.	100	3½	3½	86 — 88	..	3 19 7
Smithfield Markets, Ord.	5	Nil	Nil	1⅜ — 1⅝	..	Nil
South London, Ord.	4	5	5	2 13/16 — 3 1/16	— 1/16	6 5 0
Do. 5 % First Mort. Deb.	100	5	5	101 —104	..	4 16 2
South Metropolitan, 7 % Pref.	1	7	7	1⅜ — 1½	..	5 12 0
Do. 4½ % First Deb. Stock	100	4½	4½	97 —100	..	4 10 0
Urban, Ord.	5	5	3⅝	⅞ — 1	..	18 15 0
Do. 5 % Cum. Pref.	5	5	3⅝	2⅜ — 3	..	6 5 5
Do. 4½ % First Mort. Deb.	100	4½	4½	87 — 89	..	5 1 2
Westminster, Ord.	5	10	10	7⅞ — 8¼	..	5 14 3
Do. 4½ % Cum. Pref.	5	4½	4½	5 — 5⅜	..	4 3 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5½ — 5⅝	..	5 4 4
Calcutta, Ord.	5	8	8½	6⅜ — 7⅛	..	5 19 4
Do. 5 % Pref.	5	5	5	4¼ — 5⅜	..	4 13 0
Calgary Power, 1st Mort. Bds.	100	5	5	96½ — 98½	+ ½	5 1 6
Canadian Gen. El. Com.	$100	6	6	108 —111	+2	5 10 1
Do. 7 % Pref.	$100	7	7	121 —124	..	5 12 11
Cordoba Lt., Power and T., Ord.	1	..	6	1⅜ — 1⅝	..	6 8 0
Do. 5 % Deb.	100	5	5	94 — 97	..	5 3 1
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	..	6	94 — 96	—1	6 5 0
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	87 — 90	..	5 11 1
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	83 — 85	..	5 17 8
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	Nil	1/16 — 3/16	..	..
Do. 6 % Pref.	1	6	6	15/16 — 1 3/16	..	8 6 8
Kaministiquia Power, 5 % G. Bs.	$500	5	5	103½ — 105½	..	4 14 9
Madras, Ord.	5	Nil	Nil	2⅝ — 3⅛	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	94 — 96	+2½	5 4 2
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	88 — 90	..	5 11 1
Mexican Lt. & Power, Common	$100	4	4†	82½ — 84½	..	4 14 8
Do. 7 % Cum. Pref.	$100	7	7	106 —108	..	6 9 8
Do. 5 % 1st Mort. Gold Bds.	..	5	5	94 — 95	..	5 5 3
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	89½ — 91½	..	5 9 3
Montreal, Lt., H. and Power	$100	..	8	171 —175	+8½	4 11 5
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5	59 — 61	—4	8 4 0
River Plate, Ord.	Stock	9	10	218 —228	..	4 7 9
Do. 6 % Non-Cum. Pref.	Do.	6	6	107 —114	..	5 5 3
Do. 5 % Deb. Stock	Do.	5	5	104 —106	..	4 15 3
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	100 —102	..	4 8 3
Shawinigan Water, Capital	$100	5	5	115 —118	..	4 4 9
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	109 —111	..	4 10 1
Do. 4½ % Per. Deb.	Stock	4½	4½	103 —105	..	4 5 9
Toronto Power, 4½ % Deb.	Do.	4½	4½	99 —101	..	4 9 1
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	93 — 95	..	5 5 3
Victoria Falls Power, Pref.	1	Nil	Nil	1 — 1 1/16	+ 1/32	..
Do. (new)	1	..	Nil	31/32 — 1 3/32	+ 1/32	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	..	6	108 —110	..	5 9 1

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	Nil	Nil	7⅜ — 7⅝	..	Nil.
Do. 5 % Deb. Red.	Stock	5	5	100 —102	..	4 18 0
American Telep. & Teleg., Cap.	$100	8	8	153 —155	—3	5 4 7
Do. Collat. Trust	$1000	4	4	96 — 98	..	4 1 8
Anglo-American Telegraph	Stock	3⅜	3⅜	69 — 71	..	5 5 3
Do. 6 % Pref.	Do.	6	6	113 —114	..	5 5 3
Do. Def.	Do.	25/-	30/-	26⅜ — 26⅞	..	5 11 7
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	101 —103	..	4 17 1
Chili Telephone	5	8	6†	7 1/16 — 7 5/16	..	5 11 11
Commercial Cable, Stlg. 4% Deb.	Stock	4	4	88⅜ — 90⅜	..	4 8 5
Cuba Telegraph	10	6	6	10 — 10⅜	..	5 11 7
Do. 10 % Pref.	10	10	10	17½ — 18½	..	5 9 7
Direct Spanish Telegraph, Ord.	5	4	4	3⅜ — 4	..	5 0 0
Do. 10 % Cum. Pref.	5	10	10	8⅜ — 8⅞	..	5 14 3
Do. 4½ % Debs.	50	4½	4½	101 —103	..	4 7 5
Direct United States Cable	10	4	5	7½ — 8	..	6 5 0
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	100 —102	..	4 9 1
Eastern Telegraph, Ord. Stock	Stock	7	7	136½ — 139½	+ ½	5 0 4
Do. 3½ % Pref. Stock	Do.	3½	3½	84 — 86	..	4 1 5
Do. 4 % Mort. Deb.	Do.	4	4	101 —103	..	3 17 8
Eastern Extension	10	7	7	13⅛ — 13⅜	..	5 1 10
Do. 4 % Deb.	Stock	4	4	101 —103	..	3 17 8
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	99½ — 101½	..	3 18 10
Globe Telegraph and Trust	10	5⅞	5⅞	11 — 11½	— ¼	5 4 4
Do. 6 % Pref.	10	6	6	13⅜ — 13⅝	..	4 8 1
Great Northern Telegraph	10	18	18	31½ — 32½	..	5 10 9
Indo-European Telegraph	25	13	13	56½ — 58½	..	5 11 1
Mackay Companies Common	$100	4½	5	92 — 94	..	5 6 5
Do. 4 % Cum. Pref.	$100	4	4	75 — 77	..	5 3 11
Marconi's Wireless Telegraph	1	Nil	Nil	2 3/32 — 2 5/32	+ 1/32	Nil.
Monte Video Telephone, Ord.	1	6	6	⅞ — 1	..	6 0 0
Do. 5 % Pref.	1	5	5	⅜ — ⅝	..	5 10 4
National Telephone, Pref.	Stock	6	6	104½ — 106½	..	5 14 0
Do. Def.	Do.	6	6	120 —123	—3	4 17 7
Do. 6 % Cum. 1st Pref.	10	6	6	10 — 10⅜	..	5 11 7
Do. 6 % Cum. 2nd Pref.	10	6	6	10 — 10⅜	..	5 11 7
Do. 5 % Non-cum. 3rd Pref.	5	5	5	5 1/16 — 5 3/16	— 1/16	4 7 11
Do. 3½ % Deb.	Stock	3½	3½	99¼ — 101¼	..	3 9 0
Do. 4 % Deb.	Do	4	4	99¼ — 101¼	..	3 18 10
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	100½ — 101½	+ ½	4 9 1
Oriental Telep. and Elec.	1	8	6†	1 9/16 — 1 11/16	..	4 8 3
Do. 6 % Cum. Pref.	1	6	6	1⅝ — 1¾	..	4 16 0
Do. 4 % Red. Deb.	Stock	4	4	87½ — 89½	..	4 9 5
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	100½ — 102½	+ ½	3 18 1
Reuter's	8	5	5	8½ — 9	+ ¼	4 11 5
Submarine Cables Trust	Cert.	6	6	131 —134	..	4 8 11
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	100 —102	..	4 8 3
United River Plate Telephone	5	8	6†	7⅜ — 7⅞	..	5 2 5
Do. 5 % Cum. Pref.	5	5	5	5⅛ — 5⅜	..	4 8 11
West Coast of America	2½	2½	2½	1¼ — 1⅜	..	6 5 0
Do. 4 % Debs., 1 to 1,506 guar. by Braz. Sub. Tel.	100	4	4	99½ — 101½	..	3 18 10
West India and Panama Teleg.	10	Nil	2	2⅜ — 2⅝	..	7 12 5
Do. 6 % Cum. 1st Pref.	10	6	6	10¼ — 10⅜	..	5 11 7
Do. 6 % Cum. 2nd Pref.	10	14½	6	9⅜ — 10	..	6 0 0
Do. 5 % Debs.	100	5	5	102 —104	..	4 16 2
Western Telegraph, Ltd.	10	7	7	13⅜ — 14	..	5 0 0
Do. 4 % Deb.	Stock	4	4	101 —103	..	3 18 10
Western Union Tel., 4% Bnds. A	$1000	4	4	105 —108	..	3 14 1
Do. 4½ % Fdg. Bonds	$1000	4½	4½	99½ — 102½	..	4 7 10

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1909.	Dividends for 1910.	Closing Quotations June 26th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bath Trams, Pref. Ord.	* 1	Nil	Nil	⅛ — ⅝	..	Nil
Do. 5 % Pref.	1	5	5	2⅝ — 2¾	..	6 13 4
Do. 4½ % Deb.	100	4½	4½	79 — 83	..	5 8 5
Brit. Elec. Trac., Ord.	10	Nil	Nil	1⅛ — 1⅜	..	Nil
Do. 6 % Pref.	10	3	..	4 — 4½	..	..
Do. 5 % Deb.	100	5	5	96 — 99	..	5 1 0
Do. 4½ % 2nd Deb.	100	4½	4½	77 — 81	..	5 11 1
Central London Railway, Ord.	100	3	3	72 — 73	..	4 2 2
Do. Pref.	100	4	4	87 — 89	..	4 9 11
Do. Def.	100	2	2	60 — 62	—2	3 4 6
Do. 4 % Deb.	100	4	4	104 —106	..	3 15 6
City & South London, Ord.	100	1½	1½	31½ — 32½	—1	4 12 4
Do. 5 % Pref., 1891	100	5	5	109 —111	..	4 10 1
Do. Do. 1896	100	5	5	105 —108	+1½	4 12 7
Do. Do. 1901	100	5	5	104 —107	+1	4 13 6
Do. Do. 1903	100	5	5	103 —106	..	4 14 4
Do. 4 % Deb.	100	4	4	102 —104	+1	3 16 7
Dublin United Trams, 6 % Pref.	10	6	6	12½ — 13½	..	4 10 7
Great Northern & City, Pr'f. Ord	10	Nil	Nil	¾ — 1¾	..	Nil
Hastings Trams, 6 % Pref.	5	Nil	Nil	1½ — 2	..	Nil
Do. 4½ % Deb.	100	4½	4½	75 — 80	..	5 12 6
Isle of Thanet Trams, 5 % Pref.	5	1½	2½	2¼ — 2⅝	..	4 10 11
Do. 4 % Deb.	100	4	4	79 — 84	..	4 15 3
Lancashire United, 5 % Deb.	100	5	5	82 — 84	..	5 19 1
London Elec. Railw'ys, 4 % Deb.	100	4	4	98 —100	..	4 0 0
London United Trams, 5 % Pref.	10	Nil	Nil	3⅞ — 4⅛	—⅛	Nil
Do. 4 % Deb.	100	4	4	77 — 80	+1	5 0 0
Metropolitan Railway Consol.	* 100	1909. 1	1910. 1⅜	.. ..	..	£ s. d.
Do. Surplus Lands	100	2⅜	2⅜	47 — 47⅞	—2¼	2 18 0
Do. 3½ % Deb.	100	3½	3½	68 — 70	..	3 18 7
Do. 3½ % Pref.	100	3½	3½	93 — 95	..	3 19 8
Do. 3½ % Con. Pref.	100	3½	3½	90 — 92	..	3 16 1
Metropolitan District Ord.	100	Nil	Nil	28½ — 29	—1½	3 16 11
Do. 6 % Deb.	100	6	6	148 —150	..	Nil
Do. 4 % Deb.	100	4	4	98 —100	..	4 0 0
Do. 4 % Prior Lien	100	4	4	102 —104	..	4 0 0
Do. 4½ % First Pref.	100	..	3½	88 — 90	—1	3 16 11
Do. 3½ % Gtd.	100	3½	3½	76 — 78	..	3 12 3
Metropolitan Elec. Trams, Ord.	1	5	5½	2⅜ — 1½	..	4 9 9
Do. Def.	1	Nil	Nil	⅛ — ¼	..	5 6 8
Do. 5 % Pref.	1	5	5	3⅜ — 1½	..	Nil
Do. 4½ % Deb.	100	4½	4½	102½—104½	..	4 17 0
Do. 5 % Deb.	100	5	5	102 —104	..	4 6 2
Potteries, Ord.	1	2	..	⅛ — ⅜	..	4 16 2
Do. 5 % Pref.	1	5	5	1⅜ — 1⅝	..	..
Do. 4½ % Deb.	100	4½	4½	88 — 91	..	6 19 2
South Metro. Trams, 6 % Pref.	1	3	..	⅛ — ⅛	..	5 18 11
Do. 4 % Deb.	100	4	4	75 — 80	..	..
Underground Elec. Railways 5 % Prior Lien	..	5	5	100 —101	..	5 0 0
Do. 4½ % Bonds	100	4½	4½	100 —102	..	4 19 0
Do. 6 % Income	100	Nil	10/-	68 — 70	+1	4 8 3
Do. Power House Debs.	100	..	4	100 —102	..	0 14 3
Yorkshire (West Riding), Ord.	5	Nil	Nil	⅛ — ⅜	+ 1/16	3 18 5
Do. 6 % Pref.	5	Nil	Nil	2⅜ — 2⅝	..	Nil
Do. 4½ % Deb.	100	4½	4½	84 — 87	..	..
						5 3 6

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

						£ s. d.
Anglo-Arg. Trams, 1st Pref.	5	5	5	5⅛ — 5⅜	..	4 13 0
Do. 2nd Pref.	5	5	5	4⅝ — 5⅛	— 1/16	4 17 7
Do. 4 % Deb.	100	4	4	94 — 96	..	4 8 4
Do. 4½ % Deb.	100	4½	4½	99½—101½	..	4 8 8
Do. 5 % Deb.	100	5	5	100½—102½	..	4 15 3
Auckland Trams, 5 % Deb.	100	5	5	104½—106½	..	4 13 11
Bombay Elec. S. & Trams, Pref.	10	6	6	10⅝ — 11⅜	..	5 5 6
Do. 4½ % Deb.	100	4½	4½	98 —100	..	4 10 0
Do. 5 % 2nd Deb.	100	5	5	99 —101	+1	4 19 0
Brisbane Trams Invt., Ord.	5	8½	8½	6⅞ — 6¾	..	6 5 11
Do. 5 % Pref.	5	5	5	5 — 5⅛	..	4 13 0
Do. 4½ % Deb.	100	4½	4½	101 —104	..	4 6 7
B. Columbia Elec. Rly., Def.	100	8	8	146 —157	+1	5 6 8
Do. Pref. Ord.	100	6	6	128½—132½	+2	4 10 7
Do. 5 % Pref.	100	5	5	111 —113	+1	4 8 6
Do. 4½ % 1st Mort. Deb.	40	4½	4½	100 —103	..	4 7 5
Do. 4½ % Vancouver Deb.	100	4½	4½	102 —105	..	4 5 9
Do. 4½ % Con. Deb.	100	4½	4½	101½—102½	..	4 7 0
Calcutta Trams, Ord.	5	4½	5	5⅞ — 6⅛	+ ⅛	4 0 0
Do. 5 % Pref.	5	5	5	5⅝ — 5⅞	..	4 13 0
Do. 4½ % Deb.	100	4½	4½	102 —105	..	4 5 9
Cape Electric Trams	1	Nil	Nil	1/16 — 1/8	..	Nil
City Buenos Aires Trams (1904)	5	5	5	5⅝ — 5⅞	..	4 5 1
Do. 4 % Deb.	100	5	5	96 — 99	..	5 1 0
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	95 — 98	..	5 2 0
Havana Elec. Rly., 5 % Bonds	$1000	5	5	100½—102½	..	4 17 7
Kalgoorlie Elec. Trams	1	Nil	Nil	5/16 — 5/8	..	Nil
Do. 5 % A Deb.	100	5	5	91¼ — 94½	..	5 5 10
Do. 6 % B Deb.	100	6	5	63 — 67	..	7 9 3
La Plata Elec. Trms, Prf, 17/6 pd.	1	6	6	13/16 — 15/16	..	6 8 0
Lisbon Elec. Trams, Ord.	1	6	6	1 — 1⅛	..	4 16 0
Do. 6 % Pref.	1	6	6	1 — 1⅛	..	4 16 0
Do. 5 % Deb.	100	5	5	99 —103	..	4 17 1
Madras Elec. Tr. (1904), Deb.	100	5	5	97 — 99	..	5 1 0
Manaos Trams & Lt., 1st Deb.	100	..	5	93 — 96	—1	5 4 2
Manila Elec. R. and Ltg., Bonds	$1000	5	5	99½—101½	— ½	4 18 6
Mexico Trams Com.	$100	6	7	124 —126	+ ½	5 11 1
Do. Gen. Con. 5 % Bonds	..	5	5	94 — 96	..	5 4 3
Do. 6 % Bonds	100	6	6	100 —102	..	5 17 8
Para Elec. Rlys. & Lt., Ord.	5	..	10	7⅛ — 7⅜	+ 1/16	6 17 11
Do. 6 % Pref.	5	6	6	5⅞ — 6⅛	— ⅛	5 4 4
Do. 5 % 1st Deb.	100	5	5	99 —101	..	4 19 0
Perth (W.A.) Elec. Tr., Ord.	1	2½	..	1/16 — 1/8	..	2 13 4
Do. 5 % 1st. Deb.	100	5	5	104 —106	..	4 14 4
Rangoon El. Tr. & Sup., Pref.	5	6	6	5½ — 5⅝	..	5 4 4
Do. 4½ % 1st Deb.	100	4½	4½	99 —102	..	4 8 8
Rio de Janeiro Trams	$100	2	5	115 —116	—1	4 6 2
Do. 1st Mort. 5 % Bonds	..	5	5	102½—103½	..	4 16 5
Do. 5 % Mort. Bonds	100	5	5	95½ — 96½	+ ½	5 3 8
Sao Paulo Tram, Lt. and P.	$100	10	10	184 —186	—1	5 7 6
Do. 5 % 1st Deb.	$500	5	5	102 —104	..	4 16 2
Singapore Trams, 5 % Deb.	100	5	5	83 — 87	+1	5 15 0
Southern El. Tr. B.A., 5 % Deb.	..	5	5	98 —100	+1	5 0 0
Un. Elec. Trams Monte Video	5	7	6†	5⅝ — 6⅜	+ ⅛	5 9 10
Do. 6 % Pref.	5	6	6	5 — 5⅜	..	4 10 11
Do. 5 % 1st Deb.	100	5	5	102 —105	..	4 15 3
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	106 —108	..	4 3 4

MANUFACTURING COMPANIES.

						£ s. d.
Aron, Ord.	1	..	..	3/32 — 5/32	+ 1/32	..
Do. 6 % Pref.	1	12	9	8⅝ — 9⅜	..	6 17 11
Babcock & Wilcox	1	24	20†	5⅜ — 5⅝	..	4 5 4
Do. Pref.	1	6	6	1⅜ — 1½	..	4 0 0
B.I. & Helsby Cables	5	10	10	6⅞ — 7⅛	..	6 15 7
Do. Pref.	5	6	6	6 — 6¼	..	4 12 4
Do. Deb.	100	4½	4½	102 —104	..	4 6 7
British Thomson-Houston, Deb.	100	4½	4½	96 — 99	..	4 10 11
British Westinghouse, Pref.	3	Nil	Nil	1⅛ — 1/16	— 1/32	Nil
Do. Deb.	100	4	4	61 — 64	..	6 5 0
Do. 6 % Prior Lien	100	6	6	101 —103	..	5 16 6
Browett, Lindley, Ord.	1	Nil	Nil	3/32 — 1/8	..	Nil
Do. Pref.	1	Nil	Nil	14/6—15/6	..	Nil
Brush, Ord.	2	Nil	Nil	1/16 — 1/8	..	Nil
Do. 7 % Pref.	2	Nil	Nil	1/8 — 3/16	..	Nil
Do. 4½ % Deb.	100	4½	4½	59 — 64	..	7 0 8
Do. 4½ % Second Deb.	100	4½	4½	41 — 46	..	9 15 7
Callender's Cable	5	15	10†	8⅝ — 9⅜	..	8 0 0
Do. Pref.	5	5	5	4⅞ — 5⅛	..	4 17 7
Do. Deb.	100	4½	4½	102 —104	..	4 6 7
Castner-Kellner	1	17½	7½†	3⅜ — 3½	— 1/32	5 1 6
Do. Deb.	100	4½	4½	104 —107	..	4 4 1
Crompton & Co.	3	Nil	Nil	⅛ — ⅜	..	Nil
Do. Deb.	100	5	5	60 — 70	..	7 2 10
Dick, Kerr	1	5	6	13/16 — 15/16	..	6 8 0
Do. Pref.	1	6	6	1 — 1 1/16	— 1/32	5 9 7
Do. Deb.	100	4½	4½	97 —100	..	4 10 0
Edison & Swan, A, £3 paid	5	Nil	Nil	1⅛ — 1⅜	..	Nil
Do. fully paid	5	Nil	Nil	1⅞ — 2⅛	..	Nil
Do. 4 % Deb.	100	4	4	69 — 73	..	5 9 7
Do. 5 % Second Deb.	100	5	5	78 — 81	..	6 3 5
Electric Construction	2	Nil	Nil	1⅜ — 1 1/16	+ 1/16	Nil
Do. Pref.	2	7	7	1⅞ — 2	..	7 0 0
Greenwood & Batley, Pref.	10	7	7	10½ — 10⅞	..	6 10 3
Do. Deb.	100	5	5	102 —103½	..	4 16 7
General Electric, Pref.	10	5	5	8⅞ — 9¼	..	5 8 1
Do. Deb.	100	4	4	88 — 93	..	4 6 0
Henley's, Ord.	5	15	15	12½ — 12⅞	..	5 16 6
Do. Pref.	5	4½	4½	4⅝ — 5⅛	..	4 7 10
Do. Deb.	100	4½	4½	106 —108	..	4 3
India-Rubber, G. & T.	10	10	10	11½ — 13½	..	7 8
Do. Pref.	10	5	5	10⅜ — 10⅝	..	4 13 0
Telegraph Construction	12	17½	20	36½ — 38½	..	6 5 0
Do. Deb.	100	4	4	100 —102	..	3 18 5
Willans & Robinson	1	Nil	Nil	⅜ — ⅝	..	Nil
Do. Pref.	5	3	Nil	¾ — 1	..	Nil
Do. Deb.	100	4	4	55 — 65	..	6 3 1

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Bank rate of Discount 3 per cent., March 9th, 1911.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING MAY, 1911.

THE figures of the May exports show a decided recovery over those of the previous month, the total £379,050 being nearly £70,000 better. Although this total does not apparently compare well with last year's high average of £473·4 thousand per month, the latter was, of course, due to some exceptional telegraphic exports, and it is satisfactory to note that the May exports total, excluding telegraphic material—£342,644—is one of the best we have recorded, and a great improvement on the comparable monthly average of 1910, viz., £284·5 thousand.

Of the individual items, machinery, cable and lamp exports are all much better than in April.

The import section, with a total of £200,749, shows some falling-off as compared with the April total of £225,138; the May figure is, however, much above the average of 1910.

Imports of machinery are down some £36,000, while lamp and cable imports also show a lesser falling-off as compared with April; on the other hand, some improvement is shown in the telegraphic and telephonic and carbon imports. The re-exports, at £21,021, compare with £25,176 in April, and on the average show little variation.

The best customer of the month was Japan, with N.S. Wales, India, Brazil and Canada following. Germany imported nearly £130,000 worth of goods into this country during the month.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric lamps and parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	623	543	66	227	53	3,062	...	28	...	210	426	5,268
Germany	556	529	26	519	931	3,587	1,214	...	...	180	30	7,602
Netherlands, Java and Dutch Indies	841	1,935	184	79	26	1,877	70	1	...	7	84	5,104
Belgium	1,322	883	146	137	190	1,858	12	...	...	1,558	...	6,106
France	1,801	57	688	197	2	3,734	146	8	...	82	617	7,332
Portugal	194	71	39	...	...	131	...	23	...	67	47	572
Spain and Canary Isles	343	...	198	15	745	1,169	3,000	14	...	...	196	5,680
Switzerland, Italy and Austria-Hungary ...	1,184	48	220	120	74	7,542	899	4	...	45	12	10,148
Bulgaria, Roumania and Turkey	181	36	37	358	41	722	752	...	...	86	115	2,328
Channel Isles, Gibraltar, Malta and Cyprus ...	58	225	124	34	31	140	...	4	...	16	223	855
U.S.A., Philippines and Cuba	276	237	13	334	149	4,235	80	...	952	...	263	6,539
Canada and Newfoundland	691	8,565	405	1,097	2,391	7,104	11	254	...	115	948	21,581
British West Indies, British Honduras and British Guiana	29	...	45	183	...	150	...	71	...	15	83	576
Mexico and Central America	30	98	9	45	...	4,532	19	...	...	1,461	35	6,229
Peru, Uruguay and Paraguay...	261	33	203	150	...	271	...	10	16	56	191	1,191
Chile	73	70	118	...	55	2,678	...	46	...	38	...	3,078
Brazil	306	2,206	241	174	216	13,000	529	6,088	94	3,017	736	26,607
Argentina	3,217	1,840	1,113	1,006	79	3,433	686	1,128	213	741	5,995	19,451
Colombia and Venezuela	8	...	87	61	...	1,599	...	...	...	323	...	2,078
Egypt, Tunis, Morocco and Persia	489	...	125	82	118	923	874	218	...	5	402	3,236
British West Africa and St. Helena	25	12	83	141	...	43	...	7	...	120	5,230	5,667
Rhodesia, O.R.C. and Transvaal	1,700	1,791	501	2,174	50	5,895	385	378	62	...	717	13,653
Cape of Good Hope	769	942	214	495	97	1,919	...	340	37	2,885	313	8,011
Natal	1,380	7,353	403	479	322	6,664	26	37	...	82	374	17,120
Zanzibar, Brit. East Africa, Mauritius & Aden	207	99	90	145	...	116	7	45	...	15	42	766
Azores, Madeira and Portuguese Africa ...	62	168	2,265	60	133	30	15	25	...	50	586	3,394
French African Colonies and Indo-China ...	63	385	5	...	...	25	...	...	...	...	...	478
China and Siam	637	308	345	439	82	536	38	1,005	...	374	15,732	19,496
Japan and Korea	838	9,245	305	230	134	24,834	5,009	762	21	12,751	17	54,146
India	2,988	10,975	2,340	1,933	432	6,400	2,040	2,145	124	426	891	30,694
Ceylon	155	456	225	566	70	341	...	32	...	348	...	2,193
Straits Settlements and Fed. Malay States ...	284	582	419	573	286	1,694	32	54	...	161	1,090	5,175
Hong Kong and Wei-Hai-Wei	65	155	358	208	25	586	192	38	...	324	23	1,974
West Australia	305	467	230	67	247	609	10	27	...	657	...	2,619
South Australia	660	361	347	283	158	1,146	11	...	...	596	32	3,594
Victoria	983	5,899	259	995	1,129	2,245	...	395	63	861	747	13,576
New South Wales	2,188	4,770	515	2,285	95	15,993	240	2,061	12	5,781	...	33,940
Queensland	563	1,671	150	206	...	825	458	361	...	505	...	4,739
Tasmania...	47	...	...	45	...	...	...	...	...	80	120	292
New Zealand and Fiji Islands	847	2,071	536	508	830	7,630	296	301	...	2,874	69	15,962
Total, £	27,249	65,086	13,677	16,650	9,191	139,278	17,081	15,910	1,594	36,948	36,386	379,050

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Russia, Norway, Sweden and Denmark ...	325	...	6	86	...	1,833	250	552	69	3,622	6,743
Germany	777	3,873	2,391	26,538	1,796	52,000	1,644	1,014	6,182	33,674	129,889
Holland	25	...	...	1,709	...	17	...	...	...	334	2,085
Belgium	311	1,392	20	84	52	1,201	4	742	735	5,088	9,629
France	2,303	264	1,156	1,991	532	226	...	1,563	3,206	5,506	16,747
Switzerland	11	261	52	79	126	2,208	...	...	89	3	2,829
Italy	40	1,196	...	9	4	150	60	...	...	4,175	5,634
Austria-Hungary	...	906	...	1,654	...	24	...	6	543	255	3,388
United States	4,022	23	219	575	...	9,377	7,879	71	106	1,198	23,470
Total, £	7,814	7,915	3,844	32,725	2,510	67,036	9,837	3,948	10,930	53,855	200,414

Additional imports: Spain, carbons, £235; Japan, machinery, £25; Canada, goods, £45; and Newfoundland, telegraph material, £30.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Various countries, mainly as above	5,208	1,955	...	2,759	...	4,345	...	356	577	5,821	

TOTAL EXPORTS: £379,050. TOTAL RE-EXPORTS: £21,021. TOTAL IMPORTS: £200,749

NOTE.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns. Imports are credited to the country whence consigned, which is not necessarily the country of origin.

GLOBES, SHADES AND REFLECTORS.

By C. TOONE.

(*Concluded from page* 1021.)

Effect of Dirt on Absorption Coefficients.—How great may be the loss of light due to dust and dirt on globes and reflectors, and how correspondingly great the necessity for scrupulous cleanliness in this part of the illuminating equipment, is very imperfectly realised—if, indeed, we may judge by the wide-spread neglect of all the precautions dictated by these facts. The cost of cleansing lamp bulbs, reflectors and globes in a large installation is naturally considerable, but when loss of light, to the extent of from 10 per cent. to 40 per cent. of that primarily available, follows the neglect of cleanliness, the incentive to periodical attention becomes highly commercial as well as hygienic. The efficiency of a *lamp* yields place in practice to the efficiency of the *installation* as a whole, and to maintain the latter thorough cleaning should be performed as often as possible, but, above all, *systematically*. Oil splashes and dirty finger-marks collecting on the reflectors of pendant lamps used for the local lighting of machine tools and work benches are no less (and no more) injurious to efficiency than the dirt deposited on other lamps and fittings, free from handling, but exposed to the inevitably dust-laden atmosphere of the modern workshop, factory or street. In the latter case, however, the dirt is lightly deposited—in a wholly different manner to the oil splashes and daubs on the handled reflector—and, providing the reflector is not damp or greasy, subsequent draughts may largely remove the dust. Thus it is that many reflectors and globes retain quite a tolerable efficiency though never given any special care in cleaning; periodical and systematic attention is, however, far preferable to such hazardous conditions.

Ground glass and prismatic glass need specially careful attention, the facilities for the adherence of dust being great, while, at the other extreme, the smooth, shiny surface of Nernst bulbs, of most opalescent glass, and of enamelled reflectors, favours the removal of dust by air currents.

Where metallic-filament lamps, gas mantles or other fragile sources of illumination are employed, it is often only practicable to clean the fittings thoroughly when replacing the lamp or mantle, and this opportunity should, of course, always be seized. Again, whereas a damp rag cleans smooth, shiny surfaces, brush scrubbing, more or less vigorous, and with or without soapy water, is necessary to clean prismatic or ground glass and shades.

The desirable frequency of cleaning varies with the service and situation concerned, with the dust prevalent, and with the importance of maintaining maximum illumination. Most globes and reflectors should be cleaned at least once in 30-60 days, but in arc lamp equipments the fouling of the globes may be so rapid that it becomes necessary to balance the cost of cleaning against the monetary equivalent of the loss of light otherwise incurred.

The present section may be closed by the inclusion of Table VI showing the actual percentage losses attributable to dirty globes and reflectors in various services and circumstances.

TABLE VI.—Dirt on Globes, Reflectors, &c.

Particulars of case.	Per cent. loss of illumination due to dirt.	Authority.
'Alabaster' glass globe (Nernst) mean*	6 } per 100 hrs.	Eustice
" " " maximum	12½ } service	Eustice
Acid-frosted glass bulbs	6 per 600 hours	—
" " "	10 per 2 months	McDonald
Prismatic glass shade	13 per 1 year	McDonald
Nernst lamp globe (various) ...	5 to 10 or 15	—
Filament lamp and globe, dirty ...	14 }	Pearson
Globe alone, dirty	9 }	
Arc lamp globe (opal) (bad case)† ...	20	—
Prismatic reflector (for glow lamp), dirty‡	35 per 6 weeks	Eustice
Ditto, after dusting	20	Eustice
Enamelled metal reflector (over machine tool), finger-marked ...	20	Marks
Ditto, old reflector, oil spattered ...	45	Marks
Ditto, over drilling machine, old, dirty	70§	—
Desirable max. deterioration, due to dust and dirt, between cleanings...	5 to 10 per 30 to 60 days	—

* Normally dry situations.

† Where flame arcs are employed, the absorptive effect of the fumes collecting within the globe is quite appreciable—as may also be testified by any person using lumen-meters (or "diffusometer" chambers) for the purpose of finding the M.S.C.P. of naked flame arcs; whereas most other globes foul exclusively on their outer surface, arc lamp globes may easily be dirtier internally than externally.

‡ Dirt not sticky; necessity for scrubbing evident.

§ Including lamp (carbon) deterioration—probably 15-20 per cent. loss of C.P.

It should be noted that these losses are wholly attributable to dirt, and hence might have been avoided by regular cleaning. The inevitable losses due to clear globe absorption (Table V) were experienced, in addition to those shown above, and as well as a steadily increasing loss due to lamp ageing in the case of electric filaments and gas mantles.

Subsidiary Means of Securing Diffusion.—Among the chief of these may be enumerated the use of lamps of low intrinsic brilliancy (Table I), the extension of the effective diffusing surface to the whole surroundings of the lamp and variations in the location of the lamp itself.

The Cooper-Hewitt mercury vapour lamp, and the Moore tube lamp, have been the most radical advances of recent years towards the attainment of a source of such intrinsic brilliancy as might be employed without the intervention of diffusing screens. Great as is the improvement effected by these lamps over arcs and filament lamps (see Table I), they are still considerably brighter than the most intense source generally considered advisable in the direct field of view. Nevertheless, the problem of diffusing illumination is greatly simplified by the use of one or other of these

TABLE V.—Percentage Absorption of Clean Materials.—(See also Table VI.)

Material.	Value according to:—					Suitable average.	Miscellaneous.	
	Bell.	Darch.	Morris and Farrow.	Smith.	Wickenden.		Value.	Authority.
Clear glass	10	5	10—15	—	—	10	6	Stine.
" arc globe	—	—	—	—	—	—	30	Marchant.
" "	—	—	—	—	—	—	47	Ayrton.
Prismatic glass	—	—	—	21	12—15	15	10	Best result.
Light alabaster	15	—	—	—	15—30	20	—	—
Heavy "	—	—	—	—	25—40	35	—	—
Light sand blasted	—	—	—	—	12—20	20	—	—
Ground glass...	25—30	—	—	24·5	18—30	25	—	—
Frosted	—	—	—	—	—	—	11	Stine.
Opal (dense)	25—60	50	20—40	32·25	30—60	30—50	70—80	Marchant.
"	—	—	—	—	—	—	57	Blondel.
Milky glass	30—60	—	15—25	—	—	35	20	Denman Jones.
Opaline	20—40	—	—	23	25—40	35	—	—
Translucent	—	up to 60	—	—	—	20—40	—	—
Clear-stained Glass:—								
Canary yellow	—	—	—	—	—	—	18	Abney.
Deep green	—	—	—	—	—	—	80·95	Abney.
" ruby	—	—	—	—	—	—	87	Abney.
" cobalt blue	—	—	—	—	—	—	96	Abney.

tubular lights, always providing that their peculiar colour is not objectionable: by slinging the lamps high enough to lie outside the normal angle of upward vision, screening devices of all descriptions can be dispensed with.

Though far too bright to be used without enclosure, it should be noted that flame arcs have a much lower intrinsic brilliancy than carbon arc craters, and are correspondingly more suitable for uniform lighting schemes.

By utilising the diffusing power of walls, ceilings, and similar surroundings, the general uniformity of lighting can be vastly improved, and it is in the appreciation and utilisation of this fact that the greatest advances have been made during recent years in the illumination of interiors. "Concealed" lighting, now deservedly so popular, depends wholly upon the diffusing and reflecting properties of ceilings and walls, while "inverted" lighting, on precisely the same principle, depends upon the diffuse reflection from a similar, but smaller and specially prepared, reflecting surface. Whitewashed ceilings are comparatively efficient reflectors (Table IV), their exact value varying with their natural tint, surface dirt and so on, and where the walls of a room can also be relied upon to reflect, say, 50 per cent. of the light incident upon them, very uniform and efficient lighting can be secured. Unfortunately, the colours of the paper, upholstering, &c., usually favoured in living rooms, seldom reflect more than 20—30 per cent. of their incident light,

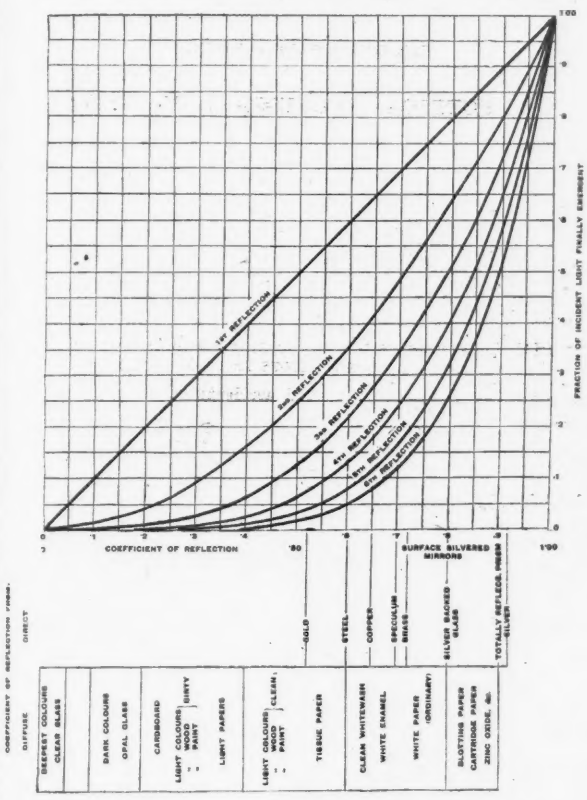


FIG. 4.

but even so, diffuse reflection, however limited, should be utilised wherever possible. To this end all table pendants, wall brackets and such like, should have open or clear tops unless the lamps are so near the ceiling as to cause sharp contrasts thereon.

How desirably low the intensity of such diffuse wall and ceiling reflection may be, is shown by Table I, while how important it is, is evidenced by the greater number of lamps required in a darkly papered room than in the same room decorated throughout in white, cream, or yellow.

By repeated reflection, whether direct or diffuse, a given incident illumination rapidly loses its intensity, and generally, by the selective absorbing properties of the reflecting surfaces used, acquires a predominant colour varying with the material of these surfaces. This acquired colouration is greater in the case of diffuse than of direct reflection, while, by an extension of the same principle, it is greater in the case of deep or "piled" diffusing surfaces than in such cases as shiny cloth or paper (see Table IV and footnote).

The curves given in fig. 4 show the percentage of the originally incident light which is available after one, two, three, &c., reflections from materials of various coefficients of reflection; it is assumed that the law of the first applies to each subsequent reflection—an assumption nearly justified by experiment, particularly in cases of direct reflection. For convenience, the data of Tables III and IV are given in abstract along the axis o x in fig. 4.

In street lighting in particular is an extended utilisation of diffuse illumination desirable. The present arrangement—whereby street lamps at night too often present the appearance of a series of gradually diminishing, but always intense, disks and dots of light, set in a background made doubly dark by contrast—is radically wrong, and the most obvious improvement would be to require all houses, walls, &c., facing the street to be white or cream in colour, so as to aid by diffusion in the general illumination of the roadway. This device would alone effect a vast improvement in the majority of town streets. Another simple and effective means of securing even illumination in streets, factories and large halls alike is to employ high candle-power units slung very high and pitched proportionately far apart. This principle is exemplified in many city streets lighted by high-slung flame arcs of 2,000 or more M.S.C.P. each; in many modern workshops, where the single-storey system of building and the high roof required to accommodate overhead cranes, &c., facilitate the introduction of the system in question; and in the Albert Hall, London, among other famous buildings of this nature.

Whether it is preferable, in any particular case, to provide an elaborately designed globe and reflector system or to rely largely upon natural diffusion from the surroundings, must be determined by allowance for every item of expenditure and by a detailed consideration of all factors and circumstances peculiar to the case in point. In this often difficult, and always important, decision, and in all its side issues, it is hoped that the present notes will be of considerable assistance to all parties concerned. Long though the article has been, the writer trusts that it is not diffuse and that the paramount importance of the subject treated will excuse the bulk of the dissertation thereon.

CONTRACTS IN RESTRAINT OF TRADE.

[FROM A LEGAL CONTRIBUTOR.]

THE time of the Chancery judges is frequently occupied in considering whether contracts "in restraint of trade" shall or shall not be enforced. Seeing that nearly every agreement to employ a manager or a traveller contains a clause of this kind, it is not unimportant to note these cases as they come up for consideration.

In a case heard recently (Stuart *v.* Halstead, June 13th), it appeared that the plaintiffs were advertising agents, and that the defendant had agreed with them that she would not commence, carry on, or be engaged, directly or indirectly, in any business similar to that carried on by the plaintiffs, and in which she acted as manager, in any part of the United Kingdom. The defendant, having left the plaintiffs' service, entered the employment, as saleswoman, of a rival firm called the Trade Extension Society. The plaintiffs thereupon brought this action, and launched a motion for an interim injunction to restrain her from breaking her agreement pending the trial of the action. It was contended on behalf of the defendant that the agreement was too wide, and therefore void, on the ground of public policy.

Mr. Justice Eve, in giving judgment, said he was satisfied that the defendant understood the effect of the agreement, and if the agreement was otherwise enforceable, he would be prepared to hold that the defendant had become engaged in a business similar to that carried on by the plain-

tiffs. On the evidence, he would come to the conclusion that the agreement, if otherwise binding, would prevent her from acting as saleswoman in her present employment. But the question was whether the agreement ought to be enforced on an interlocutory application. He pointed out that if there was one thing more than another essential to the trade and commerce of this country it was the inviolability of contracts deliberately entered into. But according to the authorities the restraint was void as being too wide and could only be justified by special circumstances. Were there any such special circumstances here? The only evidence was that this business was carried on all over the United Kingdom to this extent, and that the plaintiffs were prepared to enter into contracts within that area. Further, it was said that the defendant had acquired information as to the details of the business, but it was difficult to see what secret information there was to acquire. Then it was said that it was essential that the plaintiffs should be protected, but that only meant that the plaintiffs were advised that they had a good cause of action. The Court ought not to accept the statement that protection was essential unless the grounds for it were stated, and it must be satisfied that there were special circumstances before the restraining of the defendant from competing anywhere in the United Kingdom. In these circumstances no interim injunction was granted.

As this case is only part heard, it would not be proper to comment upon it. But there are certain expressions used in the judgment which may be difficult for those unaccustomed to the forms of law to fully understand. Why, for instance, should a restrictive covenant ever be void at all? Why did the learned judge refuse to enforce it on this occasion?

A restrictive covenant is avoided as being against public policy if it prevents a man disposing of his labour as he wills. If A enters the service of B as a traveller in electrical fittings and agrees that, after the end, or sooner determination, of his contract of service he will never carry on that business anywhere for the rest of his natural life, this covenant will be void as against public policy. But where the covenant is not too wide, but is reasonably necessary for the protection of both parties, the Courts will enforce it. The rule was thus expressed by Lord Macnaughten in the well-known case of Nordenfelt *v.* Maxim Nordenfelt Guns and Ammunition Co. The true view at the present time is this: "The public have an interest in every person carrying on his trade freely, so has the individual. All interference with individual liberty of action in trading, and all restraints of trade of themselves, if there is nothing more, are contrary to public policy, and therefore void. That is the general rule. But there are exceptions; restraints of trade and interference with individual liberty of action may be justified by the special circumstances of a particular case. It is a sufficient justification, and, indeed, it is the only justification, if the restriction is reasonable—reasonable, that s in reference to the interests of the parties concerned, and reasonable in reference to the interests of the public, so framed and so guarded as to afford adequate protection to the party in whose favour it is imposed, while at the same time it is in no way injurious to the public. Time was when all agreements in restraint of trade and liberty to work, were regarded as against public policy and invalid. But this view of the law was found mischievous and intolerable, and it was gradually disclaimed and modified. The modern doctrine, as I understand it, is that if an agreement restraining a person from carrying on business is injurious to the public interests of this country, such agreement is invalid to the extent to which it is injurious, but not further, if it is so framed to permit of division into two portions, one of which is good and the other bad."

In that very case, however, a covenant which was world-wide in its operation, was upheld on the ground that it only granted reasonable protection to the parties. In another case (Underwood *v.* Barker) the plaintiffs, who were hay and straw merchants at Brentford, carried on an extensive business, wholesale and retail, in the United Kingdom, France, Belgium and Canada, and had permanent places of business in the United Kingdom and France. In October, 1897, they agreed to employ the defendant as their clerk and foreman, in Calais or elsewhere, at a weekly wage of 35s. The defendant entered into a covenant that he would not, for the space of 12 months after his leaving or being dismissed, carry on the business of a hay and straw merchant, or enter into the service of, or act as agent for, any person or persons carrying on the business of a hay and straw merchant in the United Kingdom or France, or in the Kingdom of Belgium or Holland, or in the Dominion of Canada. The defendant continued in the plaintiffs' employment until November, 1898, when he voluntarily left them and entered into the employment of a rival hay and straw merchant in London. It was held by Lindley, M.R., and Rigby, L.J., Vaughan Williams, L.J., dissenting, that the restraint imposed upon the defendant was not unreasonable, at any rate so far as the United Kingdom was concerned; that the covenant was not void upon any ground of public policy; and that the defendant must be restrained from violating his covenant.

It will be noticed that the covenant was severed in this case, that is to say, it was declared valid as to the United Kingdom.

In the case under review, however, the Court apparently came to the conclusion that the United Kingdom was too wide a limit, having regard to the nature of the business.

The lesson to be learnt from these cases is that when considering the terms of a restrictive covenant, care should be taken not to make it too wide in its operation. If it errs in this regard, its whole object may be frustrated.

ELECTRICAL ACCIDENTS IN 1910.

(*Concluded from page* 993.)

THE increasing use of electrical energy for motive power in factories is again indicated. An addition of 70,000 H.P. during the year brings the known total of motors connected to public supply mains up to over 630,000. In spite of the low price at which electrical energy can be purchased in many districts, occupiers of large works continue to put down new electrical generating plant of their own.

TABLE I.—ACCIDENTS AT ELECTRICAL GENERATING STATIONS AND SUB-STATIONS IN 1910.

The small figures relate to fatal accidents, and are included in the principal figures:—

Description.	Public supply stations and electric railways and tramways.	Other stations.
Non-electrical:—		
At engines, pumps and generators ...	31[1]	6
At boilers and steam plant	44[2]	5
At coal-handling plant	16	1
Falls...	68[2]	10
Struck by falling bodies	19	3
Miscellaneous	104	10
Total	282[5]	35
Electrical:—		
At switchboards when engaged in ordinary routine work—mostly due to faulty design of apparatus or to mistakes on the part of the switchman...	15	2
Cleaning, repairing, &c., at "live" switchboards or other "live" conductors	16[2]	7
Cleaning, repairing, or other handling of switchboards or apparatus supposed to have been made "dead":—		
Skilled persons	5[1]	—
Unskilled persons	—	—
Adjusting brushes and cleaning commutators	2	1
Miscellaneous	7[1]	3
Total	45[4]	13

The mechanical accidents are somewhat fewer than in the previous year, the reduction being chiefly under the heading of "falls." The electrical accidents are also fewer, the number of fatalities, four, being, however, the same. The actual figure, 45, for the public supply stations, is remarkably small, and compares with 58 and 76 in the two previous years. When it is considered that the output of the electricity supply undertakings increases enormously every year, and that in the earlier tables returns from tramway undertakings (other than those having combined stations for general supply and traction) were not included, it is evident that the relative proportion of accidents to the total output of electrical energy from the stations has fallen greatly, indicating a higher

standard of safety as regards the plant and apparatus, and greater care on the part of those responsible for its operation. The Regulations may be assumed to have had a beneficial influence upon the result.

The nature of the accidents is much the same as has been described in previous reports; a few, however, may be picked out for special mention. One under the first heading occurred to a sub-station attendant. One cell of an extra-high-tension (6,600 volts, three-phase) switchboard had been made dead for cleaning purposes. The cleaning had been finished and the cell was about to be put into use again. For this purpose three isolating links, which had been removed, had to be replaced in position. These links, which were of the porcelain grip type, had to be lifted and pushed into live contacts about 8 ft. above the floor. Insulating tongs about 3 ft. in length were provided for the purpose, but owing to the great weight of the isolating links, the tongs could not be used. The attendant consequently relied upon india-rubber gloves, and in attempting to put one of the insulators in position from a step ladder, he appears to have pressed his gloved hand against the live contact portion below the porcelain part. The current pierced the glove and passed through the man from his hand to his knee, which was touching the earthed framework. He received a severe shock and burns, but escaped with his life, although it is feared that he may be permanently injured. Whether the glove was sound or not before use could not be definitely determined, but obviously the operation was not one where gloves should have been relied upon. The fault lay in the use of isolating links not provided with proper means of working, the provision of the tongs being useless, as in practice they could not be used. It has since been decided to substitute isolating links of the hinged type, which can be operated by a pole from the floor.

Under the next heading, "cleaning, repairing, &c.," at live switchboards, there were two fatalities. In each of these cases, as serious breaches of the Regulations were involved, prosecutions, already referred to, were instituted. In one case a labourer was put to work close to live unprotected conductors at 10,000 volts, and in the other a cabinet-maker not having technical knowledge such as would enable him to avoid danger was employed on hazardous work.

In one of the non-fatal cases the chief engineer of the undertaking was making an examination of a transforming sub-station when he touched a high-pressure cable, the insulation of which was faulty. Fortunately for him, he was also touching with his forearm the earthed frame of a transformer, so that although he obtained a severe shock the more serious effects of the current were limited to its passage between his fingers and arm. The resulting burns were severe, taking many weeks to heal, and he lost one finger.

Several accidents from short-circuit, resulting in severe burns, were obviously due to carelessness. Thus, there were again two cases of men taking measurements of switchboards with steel rules, and naturally making short-circuits. Two men were injured through "levelling" a live switch with a metal spirit-level, and another through the use of a stick of solder.

Under the next class, that of working at conductors or apparatus supposed to have been made "dead," there was one fatal case. Cleaning operations had been undertaken at an extra-high-pressure switchboard in a sub-station. The switchboard was fed by two incoming mains, one at each end. One of these feeder mains was dead, and the other was live. Both feeder switches were "off." The only portions of the board remaining live were, therefore, the incoming cable ends of the live main and the switch terminals to which they were connected. The bus-bars of the switchboard were divided in the centre by a switch which was also "off." One half of the board had been cleaned, and, as a matter of extra precaution, the men engaged on the work had previously placed a poker across the tail ends of the dead feeder cable. When the work on the first half was completed, one of the men took the poker off the dead cable ends and apparently intended to place it across the corresponding tail ends of the other feeder, which he evidently thought was also dead. The result was that he received a fatal shock. Another of these accidents, also at an extra-high-pressure switchboard, was due to the presence in the cell of a potential transformer connected on the "live" side of the isolating switches. The isolating switches having been withdrawn, the attendant apparently supposed that everything in the cell was dead, and he made a short-circuit, but, fortunately, escaped with only some burns. Another case, resulting in very severe burns to one man and less severe burns to another at some distance away, also occurred at an extra-high-pressure switchboard. There were a number of cells separated by brick divisions opening on to a passage way, the cells being separately provided with screens. It became necessary to make one cell dead, and this had been done by pulling out the isolating switches. As a further precaution before working in the cell, the conductors were to be earthed to the main earth cable, passing along the wall of the passage way by means of a connecting flexible cable and clamps. Instead of removing the screen from the one cell only, the attendant had removed the screen of three cells. Having connected the flexible cable to the main earth cable, he turned round to connect the other end to the conductors in the dead cell, but without noticing, he went to the adjoining live cell. The result was an explosion and destruction of the apparatus in the cell and severe injuries to himself and lesser injuries to another man standing at the entrance to the passage way.

Under the miscellaneous accidents, the fatal case occurred to a cleaner at an extra-high-tension switchboard in a sub-station, all the conductors and apparatus being dead except those of the extra-high-tension switchboard, which were under lock and key and quite inaccessible, the key being, however, kept on the premises. For some unexplained reason, probably mere curiosity, he obtained the key and opened the door of a live panel. He appears to have made a short circuit and died from the effects of the burns.

ELECTRICAL ACCIDENTS IN FACTORIES OTHER THAN ELECTRICAL STATIONS IN 1910.

The small figures relate to fatal accidents and are included in the principal figures.

Arcing of switches	48
„ fuses	13
Shock or burns from fuses when replacing fuse wires	28[1]
Portable apparatus, connectors and flexible wires	54[1]
Unprotected conductors, switches, terminals, fuses, &c.	21[1]
Working on or near live conductors—skilled persons	34
Working on or near live conductors—unskilled persons	17
Miscellaneous accidents in electrical manufacturing works—mostly in testing operations ...	30[1]
Adjusting brushes and cleaning commutators ...	7
Miscellaneous	24[1]
Total	276[5]

The total number of these accidents is slightly greater than last year. The increase of 18 accidents, or 7 per cent., is, however, much less than would be the case if, as might be expected, the rate of increase in accidents should coincide with the rate of increase in the use of electrical energy. The number of fatalities is five as against eight for last year.

The accidents from the arcing of switches, including motor-starting switches, are mostly due to defective design or to the switches not being maintained in good order. A number are due to motor-starting switches having a no-volt release not being maintained in proper order, and failing to return to the starting position. On the next occasion when the motor switch is put on there is consequently a flash, and the man gets his hand burned.

The accidents from the arcing of fuses are in nearly all cases due to absence of protection of the fuses, and are consequently due to a breach of the Regulations. Similarly with automatic cut-outs, which are often placed at the height of a man's face, and sometimes in a confined space, such as in the driving cabin of a crane where there is great risk of the man being injured by the flash.

Accidents when replacing fuses are often due to the use of badly-designed fuse-holders. Fuse-holders are, however, not always used the fuse wires being directly attached to the fixed terminals. This method is allowed by the Regulations provided that the fuses are so protected by a switch that there is no danger, the fuse terminals being made dead by first pulling out the switch. A number of accidents have, however, occurred by the person failing to use the switch and attempting to replace the fuse-wires on the live terminals. In the fatal case the pressure of the system was 440 volts, or 250 volts to earth; the victim was an apprentice "electrician," 20 years of age, who omitted to pull off the switch, and took hold of the fuse carrier too low down, grasping with his thumb and finger the live contact piece, while his other hand was on the metal framework of the cabin. Although he was able to shout for help, he could not move or let go, and was killed. This accident once again demonstrates the danger of shock from alternating current of low pressure. It also emphasises the necessity of the use of fuse holders of a pattern which can be grasped without any risk of touching live metal, where there is danger of shock to earth. The only sure means of safety with fuses of this class, not in themselves "fool-proof," is to eliminate the human element by interlocking the cover of the fuse box with the switch in such a way that it can only be opened when the switch is in the "off" position.

Twenty-four accidents were due to the use of unsuitable plug connectors. The injuries were mostly burns to the hand with or without shock in addition, and in one case a fatal shock resulted. Both last year and the year before Mr. Ram described how a connector plug should be made so as to obviate the dangers. Such plugs are now obtainable from several manufacturers. In the fatal case a hand lamp with flexible wires was being connected by means of an "adapter" to a lampholder. The insulation on the flexible wires was damaged, and the man received a shock to earth. The current was alternating, and he was unable to move or let go; although assistance was at hand in a very short time, he was killed The pressure on the lamp circuit was 115 volts, but as the circuit was taken from an auto-transformer from a 230-volt circuit, the pressure of the shock was probably 230 volts. An adapter and lampholder is not a "properly-constructed connector" as required by the Regulations for use under such circumstances. The use of a connector such as the one already referred to would have prevented this fatality and the other plug accidents. Six accidents occurred in handling the portable apparatus—improperly-constructed hand lamps and drills which were not earthed.

Of the accidents from unprotected conductors, some were due to the use of bare conductors which could not be regarded as protected by position (*i.e.*, placed out of reach), seven of them being in or about the cages of travelling cranes. Others were due to the absence of protection of insulated wires in positions where they were liable to damage. The fatal case occurred to the driver of a crane in a foundry in leaving the driving cabin in a hurry owing to the explosion of a casting. He clutched the live wires, making a short-circuit, and received a shock and severe burns, from the combined effects of which he died a few days later. The accident would probably not have occurred if the man had been leaving th cabin under normal circumstances. Two other accidents in driving

cabins of cranes, in one case resulting in severe burns, were due to the drivers attempting to connect up temporary lamps to the live conductors. There should always be a permanently connected lamp or lamps in a crane cabin which can be switched on when required, and also a properly constructed connector for the use of a portable lamp when wanted.

Fifty accidents were due to persons working on live switchboards and other conductors. In most of the cases short circuits resulted, inflicting severe burns. There is seldom any real need for such work on factory premises, as the work can be done when the conductors are dead, even if it is necessary to wait until after factory hours. The unskilled persons should not have been allowed to undertake such work.

Testing operations in electrical manufacturing works are carried on very largely by pupils and apprentices, and it is chiefly amongst them that the accidents occur. The average age of 26 of the 30 persons meeting with accidents was only 22 years. Carelessness due to want of experience and insufficient supervision are, no doubt, contributory causes. On the other hand, the means provided for carrying on the tests are often faulty. Thus, old pieces of cable with the insulation worn out are used for making connections, and switches which are out of order are used for making and breaking circuit. The fatal accident, which happened to a competent man of long experience, occurred in connection with a pressure test, and appears to have been due to a mistake in signalling, the man touching the piece of apparatus under test thinking that the pressure had been cut off by the attendant at the switch some distance away.

Four accidents occurred in attempting to put new brushes into the brush-holders of motors while they were running. Amongst the miscellaneous accidents, the fatal one was due to a faulty switch. A motor on a crane was about to be overhauled, the switch being first pulled out. Owing, however, to a pin in the switch working loose and dropping out, one blade of the switch remained in contact, so that the trolley wires remained "live." The man took hold of the wires and received a fatal shock (200 volts, two-phase). Another accident from shock emphasises the necessity for properly earthing travelling jib cranes. A ship was being unloaded, and through a leakage the crane became electrically charged. A man in the ship's hold on grasping the end of the chain received a severe shock. The crane was on rails bolted to a wooden wharf.

TABLE III.—Electrical Fatalities Reported under the Factory Acts in 1910.

Month.	District.	Voltage of system.	Voltage of circuit or probable voltage of shock.	System. A = Alternating, 1 = Single-phase, 2 = Two-phase, 3 = Three-phase, D = Direct.
March	Glasgow ...	11,000	7,000	A 3
April	Glasgow ...	400	230	A 3
April	Newcastle	5,750	3,300	A 3
May...	Kent ...	440	250	A 3
May...	Leicester...	2,000	2,000	A 1
June	Leeds ...	280	200	A 2
June	Oldham ...	220	220	D
Dec....	Manchester	6,500	3,750	A 3
Dec....	Huddersfield	10,000	5,750	A 3

ON SWITCH HANDLES.

By S. LEES.

It is worthy of note that one of the effects of the Home Office 1910 Regulations has been to awaken in many quarters a more intelligent appreciation of the fact that, even "direct," the oft (mis)-called safe current, is not to be regarded altogether with impunity.

The provision of safe and efficient handling *media* for the operation of switchgear is of the greatest importance. Especially is this so in the case of industrial manufacturing processes, as in textile mills, collieries, engineering works, and so forth, where often, even to this day, electric lighting, and to a still greater extent electric driving, are regarded somewhat suspiciously as innovations come before their time. And yet, notwithstanding this, of recent years there has been a decided tendency all round to treat this detail of design with scant consideration, if the representative examples dealt with hereunder are to afford any criterion. Perhaps, like the operator sometimes, it may be that such things as switch handles and grips are tolerated only as necessary evils. Still, one would require to be possessed of a fairly lively imagination to believe that a curiously-shaped knob a trifle over an inch in diameter, mounted on a rated 100-ampere knife switch of formidable metal proportions, was seriously intended by its designer for operating the said switch. It was a real finger toaster, until the users thereof realised that Nature had never intended their digits to be put to such base uses. The sketch shown in fig. 1 speaks for

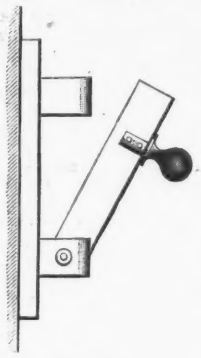


Fig. 1.

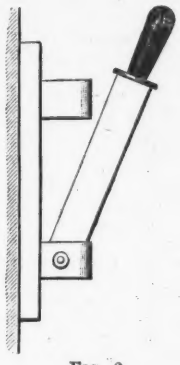


Fig. 2.

itself. The simple type of knife switch illustrated in fig. 2 is almost invariably provided with a badly proportioned handle, and the really necessary shield or guard is, if not conspicuous by its absence, at least of such an apologetic character as to afford no protection whatever to the operator. The list of similar examples could be easily extended, but repetition of this sort has a tendency to weary the reader.

It would probably be considered by many, if not most people of understanding, that a fuse-controlled circuit should always be closed by means of a switch. The writer has the temerity to suggest that here no hard and fast rule can be laid down. Circumstances alter cases, as the saying goes. The method of mounting fuse and switch-gear in tandem fashion, as illustrated in fig. 3, has had a great vogue, and, by some at least, is still considered good practice, but it can hardly

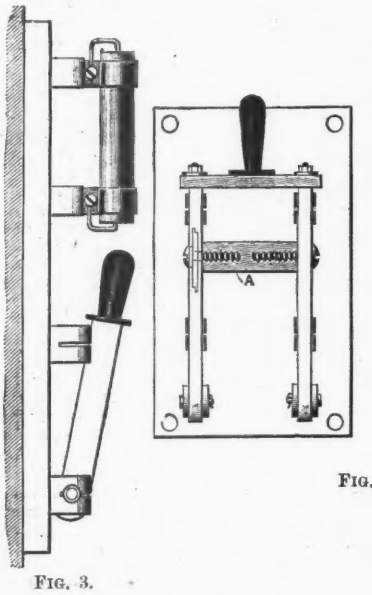


Fig. 3.

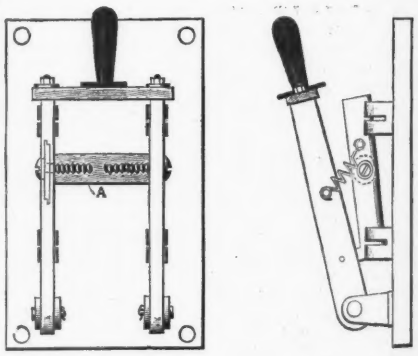


Fig. 4.

fail to be obvious to all that under certain conditions the closing by hand of the switch would, in all probability, be attended by serious results to the operator. Much of the enclosed and protected variety of fuse-gear is vastly safer to handle in operating than many of the hand-switches which the former are supposed to be subservient to.

The switch represented in the sketches, fig. 4, was responsible for a very severe case of shock, accompanied by burns of a ghastly character. A double-pole type of switch, otherwise well designed, it had one fatally weak point—namely, a wooden bar connecting both switch blades, its function, apparently, being to ensure simultaneous contact with the witch jaws. This bar was held in position by means of two metal screws passing through the respective contact

blades. These screws projected inwards to such a distance that the ends thereof were separated by barely ¼ in. space. This detail is shown clearly in section at A. The switch controlled a 500-volt heavy-current circuit. One day the wooden bar broke in operating, and, the screws fouling each other, the inevitable followed. The operator had quite a long holiday before he became convalescent. A substantial shield or guard fitted to the switch handle would have, at least, minimised the amount of damage sustained by the unfortunate operator.

Automatic switches as circuit-breakers, in particular of the non-"blow-out" type, are not always above suspicion as regards safe handling. When they are fitted with auxiliary carbon-break attachments there is considerable risk of burning to the hand when operating on, say, a "dead short" or heavily overloaded power circuit, as often occurs in daily working on the tramway service. Unprotected *live* metal parts at the top of switches in close proximity to the handles, such as nuts and screws fitted to the contact blades, are sources of danger, particularly in the smaller sizes of double-pole knife switches, and are quite unnecessary in a properly designed switch.

Motor control gears, particularly starting and regulating switches, are often fitted with handles and grips altogether inadequate for the conditions under which they are operated. The small open forms of the rheostat type are great sinners

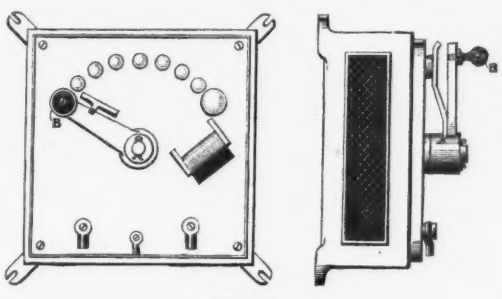


FIG. 5.

in this respect. A common example of such a starting switch is illustrated in fig. 5. The type of handle described requires to be used with care and precision, otherwise the finger (there's hardly room for two!) touches the live metal parts, usually the contact arm or the holding screw B (oftener than not also unprotected). And frequently the latter fails at its fastening, and the user—if the plant is on the hire system—takes care, after being once bitten, to operate in future by means of a safer and more easily handled medium, viz., a piece of string. A substantial handle, with a protective shield or guard, and with screw or rivet attachment of right proportion and construction, would prove the best and cheapest investment in the long run.

Happily, periodical statistical returns show that the number of accidents to workers employed on direct-current operation is comparatively small, but the writer believes that such a state of things, comforting, no doubt, is not so much due to the safe character of the gear in use, as to the education—so to speak—of the operators themselves. There is an old saying which begins, "Once bitten——"!

But when we consider the dominating influence that electric light and power are exerting over nearly all of our industries at the present time, it would be foolish to take any risks of losing prestige by continuing to use obviously unsafe switchgear, particularly in situations where its operation is in the hands of workers entirely devoid of the slightest trace of elementary electrical knowledge.

Reduction of Capital. — BRITISH HOSIERY AND ELECTROLYTIC BLEACHING CO., LTD.—A petition for reducing the capital from £60,000 to £24,525 is to be heard in the Chancery Division on July 7th.

Outing. — The annual outing of the INTERNATIONAL ELECTRIC CO. took place last Saturday week to Hastings. Dinner was served at the Waverley Hotel, and the day's excursion in glorious weather was very enjoyable.

TRADE STATISTICS OF JAMAICA.

THE following figures, showing the imports of electrical and similar goods into Jamaica during the year 1909, are taken from the official trade statistics recently issued; the figures for the year ended March 31st, 1909, are given for purposes of comparison, and notes of any increases or decreases are added; the figures of trade are now made up to the end of the calendar year, not to the end of the financial year, as formerly:—

	1908-9.	1909.	Increase or decrease.
Electrical apparatus for lighting, and parts thereof.—	£	£	£
From Great Britain	254	885	+ 631
„ United States	8,765	6,768	— 1,997
„ Germany	98	156	+ 58
„ Other countries	14	—	— 14
Total	9,131	7,809	— 1,322
Steam engines, other than agricultural.—			
From Great Britain	5,889	6,604	+ 715
„ United States	2,696	5,029	+ 2,333
„ Germany	164	251	+ 87
„ Other countries	255	105	— 150
Total	9,004	11,989	+ 2,985
Machinery, other than steam engines, and not agricultural.—			
From Great Britain	1,426	4,261	+ 2,835
„ United States	2,484	5,266	+ 2,782
„ Germany	75	60	— 15
„ Other countries	44	11	— 33
Total	4,029	9,598	+ 5,569
Railway rails.—			
From Great Britain	5,508	—	— 5,508
„ United States	1,548	108	— 1,440
„ Germany	377	—	— 377
„ Other countries	1	—	— 1
Total	7,434	108	— 7,326
Telegraph and telephone wires and apparatus.—			
From Great Britain	143	275	+ 132
„ United States	431	569	+ 138
„ Other countries	—	15	+ 15
Total	574	859	+ 285
Earthenware, china-ware, and porcelain.—			
From Great Britain	5,983	6,913	+ 930
„ United States	901	881	— 20
„ Germany	1,151	1,526	+ 375
„ Other countries	89	61	— 28
Total	8,124	9,381	+ 1,257
Scientific instruments.—			
From Great Britain	1,621	1,526	— 95
„ United States	703	495	— 208
„ Other countries	61	45	— 16
Total	2,385	2,066	— 319
Lamps, &c.—			
From Great Britain	964	1,487	+ 523
„ United States	2,694	2,861	+ 167
„ Germany	122	111	— 11
„ Other countries	42	28	— 14
Total	3,822	4,487	+ 665

The Rubber Trades Exhibition.—At this Exhibition now running at the Agricultural Hall, Islington, MESSRS. MARSHALL, SONS & CO., LTD., are represented on stand No. 31 (Messrs. Francis Shaw & Co., Ltd., Manchester) by a newly-designed gas engine, shown for the first time in this country. This engine has been put down for the purpose of supplying the necessary motive power for driving Messrs. Shaw's rubber-cleaning machinery, and is capable of developing 30 B.H.P. The engine is similar in design to the one for which the firm were awarded a Gold Medal at the Brussels International Exhibition, and some of its special features are patent precision governing, entirely supported cylinder, separate valve chamber entirely open to inspection inside, and improved valve seatings. The arrangements for the lubrication of this engine have received the most careful consideration.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

AMENDMENTS.

BRITISH SOUTH AFRICA.—The South African Customs Union Authorities have issued decisions showing the duties to be levied on certain imported goods, as follows :—

Car fittings for tramways and railways, such as blinds, rattan seating, &c.	12 % ad. val.
Insulating paper, leatheroid and cloth for electrical purposes	Free

N.B.—The above rates are those levied under the British Preferential tariff ; the rates for foreign goods are 15 per cent. *ad. val.*, and 3 per cent. *ad. val.* respectively.

CUBA.—The Cuban Chamber of Representatives has recently considered a Bill to authorise the increase by 30 per cent. of the duties on imports from countries whose exports to Cuba are less than their imports from that island. The Bill has been referred to the Committee on Customs Revenue.

UNITED STATES.—The following circular with reference to the Customs requirements as to the values of imported goods has recently been issued by the United States Government :—

"The Department is advised that it is the practice of some shippers not to include in their Consular invoices, commissions and other charges paid to them as agents for services in purchasing and shipping goods, while it is the practice of other shippers to include in their invoices such charges.

"As this difference of practice is confusing to the appraising officers, you are hereby instructed that a strict compliance with the provisions of Article 669 of the Consular Regulations of 1896 should be required.

"Article 669 of the Consular Regulations requires that shippers of goods subject to an *ad valorem* rate of duty, wholly or in part, or to a duty based upon their value, must in all cases set forth separately in the invoice :

"1. The net price of the merchandise, free from all charges of commission, packing, &c., or, in case the merchandise is shipped on consignment, the actual net market value thereof in the principal markets of the country from which the shipment is made, by its weight, measure or quantity.

"2. The cost of transportation to the port of shipment.

"3. The cost of shipment.

"4. The amount of packing charges, including boxing, tilloting, packing, cartons, &c.

"5. Insurance, commissions, discounts, legalisations, and all costs of any kind, nature or description, incurred in preparing the goods for the market of the United States, separately set forth.

"When, however, it is impossible for the shipper to give the information required under the third, fourth and fifth heads, or any of them—as, for instance, when such charges or any part of them are non-existent or unascertained at the time of shipment, or are to be paid by the consignee—such items may be omitted, the cause of omission being stated instead.

"Itemised statements of those charges are not required for merchandise not subject to *ad valorem* duty. For statistical purposes, however, the total amount of those charges should be stated."

NEW PATENTS APPLIED FOR, 1911.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

13,905. "Method of and means for maintaining constant the speed of a dynamo or other machine driven from a motor having variable speed." N. W. SAYER. June 12th.

13,945. "Telegraph instruments used in block signalling upon railways." R. R. HARPER. June 12th.

13,948. "Telephone-receiver holders." C. S. BANN. June 12th. (Complete.)

13,964. "Magnetic separation of ores or the like by the wet method." MUREX MAGNETIC CO., LTD., and M. R. A. SAMUEL. June 12th.

13,968. "Electric inductive couplings." J. SCHIESSLER. (Divided Application on 24,696/10, October 24th.) June 12th. (Complete).

13,984. "Relay device." AXEL ORLING and ORLING'S TELEGRAPH INSTRUMENTS SYNDICATE, LTD. June 12th.

13,985. "Railway signalling systems." ALLGEMEINE ELEKTRICITÄTS-GES. (Convention date, June 10th, 1910, Germany.) June 12th. (Complete.)

13,987. "Insulated electric conductors." BRITISH THOMSON-HOUSTON CO., LTD. (Allgemeine Elektricitäts-Ges., Germany.) June 12th. (Complete.)

14,005. "Method of regulating the power of an electro-magnet by either increasing or decreasing the number of turns in the windings." A. PRESTON. June 13th.

14,008. "Electrical condenser charge and discharge keys and the like." T. E. GAMBRELL and C. T. GAMBRELL. June 13th.

14,028. "Apparatus by the use of which it is possible to cause an electrical circuit to be made or broken at will from a distance by means of ether waves." P. E. YOUNGS. June 13th.

14,032. "Electric motor starters." R. H. BARBOUR. June 13th.

14,050. "Primary electric batteries." H. D. P. HUIZER. June 13th. (Complete.)

14,092. "Means for automatically actuating the track points of electric railways and the like." E. FEER. June 14th.

14,110. "Electrical wall sockets and the like." J. H. TUCKER. June 14th. (Complete.)

14,123. "Electrically-operated time-indicating systems." L. J. ARON. June 14th.

14,127. "Electric arc lamp." SIEMENS BROS. DYNAMO WORKS LTD. (Siemens-Schuckertwerke G.m.b.H., Germany.) June 14th. (Complete.)

14,140. "Electro-plating or coating of cylindrical or like revoluble articles." A. WALKER. June 14th.

14,144. "Calling circuit arrangements for automatic and semi-automatic telephone exchanges." SIEMENS BROS & Co., LTD. (Siemens & Halske Akt.-Ges., Germany.) June 14th. (Complete.)

14,148. "Electrically-operated signals for railways." AUTOMATIC ELECTRIC BLOCK SIGNALLING CO., LTD., and R. P. BROUSSON. June 14th.

14,175. "Electrical servo and telemotors, and their modes of application." L. ROTTENBURG. June 15th.

14,179. "Electrical contact-making devices." G. ST. J. DAY. June 15th.

14,183. "Globe or shade-holders such as used in gas and electric burners, also in control of air duct regulator, such as used in gas and other burners and like purposes." A. W. HEATH and C. H. HARRISON. June 15th.

14,222. "Electrically-heated vessel." H. MIETH. June 15th. (Complete.)

14,234. "Thermo-electric generators." C. V. ALBRECHT. June 15th.

14,276. "Miners' electric safety lamp." G. LEACH. June 16th.

14,303. "Electric lampholders for electrically-illuminated signs and devices." H. BEY. June 16th.

14,318. "Electrograph." M. BARRICELLI. June 16th. (Complete.)

14,360. "Magneto-generating machines particularly applicable for providing electric current for lighting and ignition purposes on motor-cycles and other motor vehicles." E. VAUGHAN. June 16th.

14,410. "Electrically-operated time-indicating devices." L. J. ARON and E. E. E. DORMAN. June 17th.

14,425. "Automatic recording devices more particularly for electrically-transmitted acoustic vibrations and the like." G. SCHNEIDER. June 17th.

14,427. "Apparatus for the control of gas valves and electric switches." A. J. BOULT. (H. W. Kanugy and G. W. de Smet, United States.) June 17th. (Complete.)

14,432. "Automatic regulators for electric circuits." SIEMENS SCHUCKERT-WERKE, G.m.b.H. (Convention date, June 17th, 1910, Germany.) June 17th. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford ; price, post free, 9d. (in stamps).

1910.

ELECTRIC HEATERS. E. G. Byng and C. H. Archer. 20,289. August 31st.

APPLIANCES FOR FIXING AND REMOVING ELECTRIC INCANDESCENCE LAMPS. F. Shirley. 22,103. September 23rd.

ELECTRIC LAMP SOCKET. J. Darby. 22,304. September 26th.

INTERRUPTER FOR IGNITION MACHINES. Firm of Robert Bosch. 24,686. October 24th. (June 22nd, 1910.)

PROCESS FOR SECURING ELECTRICAL CONTROL FROM A DISTANCE FREE FROM DISTURBANCE WITHOUT INTERCONNECTING WIRES. H. Lange. 26,368. November 11th. (November 11th, 1909.)

IGNITION DEVICES FOR INTERNAL-COMBUSTION ENGINES. H. Pieper. 27,230. November 23rd. (November 23rd, 1909.)

COLLECTORS FOR ELECTRIC TRACTION ON THE OVERHEAD CONDUCTOR SYSTEM. H. Sefton-Jones. (Oesterreichische Daimler Motorenges Akt.-Ges.) 27,798. November 29th. (Patent of Addition not granted.)

COUPLING DEVICES FOR ELECTRICALLY-DRIVEN LOOMS. Allgemeine Elektricitäts Ges. 29,309. December 16th. (December 16th, 1909.)

ELECTRIC WATER-HEATERS. H. N. Roche. 29,733. December 21st. (December 21st, 1909.)

AUTOMATIC INSTANTANEOUS SWITCHES FOR ALTERNATING AND DIRECT-CURRENT CIRCUITS. A. M. Taylor. 7,141. March 22nd. (Cognate applications, Nos. 7,414 of 1910, 9,055 of 1910, 9,674 of 1910, 10,738 of 1910, 13,889 of 1910, 14,773 of 1910, 16,211 of 1910, and 21,784 of 1910.)

ELECTRIC MOTOR STARTERS. M. B. Field and Ferranti. 12,800. May 19th.

TELEGRAPHY. S. G. Brown. 12,664. May 24th.

ART OF FUSING METALS ELECTRICALLY FOR WELDING AND REPAIRING. H. L. J. Siemund. 12,724. May 25th.

ELECTRIC TRACTION ON ELEVATED CABLE TRACKS. Firm of Ludw. Heisse. 12,843. May 26th. (October 27th, 1909.)

ELECTROMAGNETS AND ARMATURES. I. H. Parsons and A. E. Ball. 13,525. June 4th.

ELECTRIC CUT-OUTS. M. J. Railing and C. C. Garrard. 15,988. July 5th.

MEANS FOR CONNECTING ELECTRICAL CONDUITS TO THEIR FITTINGS. W. B. Incledon and A. J. Incledon. 17,426. July 22nd.

MANUFACTURE OF TUNGSTEN FILAMENTS. A.E.G. Union Elek. Ges. 19,095. August 13th. (August 14th, 1909.)

TELEPHONE RECEIVERS. M. S. Conner. 19,517. August 20th.

ELECTROMAGNETIC ALTERNATING-CURRENT APPARATUS FOR OBTAINING MEASURING, REGULATING, MOTIVE OR ADJUSTING MOVEMENTS. F. Krizik. 19,557. August 26th. (Divided application on No. 651 of 1910. May 27th.)

ANODES FOR ELECTROLYTIC PURPOSES. H. E. Beach. 20,180. August 30th.

ELECTRIC IGNITION DEVICES FOR INTERNAL-COMBUSTION ENGINES. H. Batt. 21,236. September 12th. (Addition to No. 28,818 of 1909.)

ELECTRIC FIRE-ALARM. W. Voigtlaender. 21,869. September 14th.

ELECTRIC STEAM-GENERATORS. H. D. Shelton. 22,293. September 26th.

MEANS FOR THE CONTROL OF ELECTRIC PRESSURE AND CURRENT REGULATORS. W. J. Poole. 23,314. October 18th.

PORTABLE ELECTRIC BATTERY LAMPS, MORE ESPECIALLY SUITABLE FOR MINES. T. C. Rutter. 25,991. November 8th.

ELECTROLYTIC MANUFACTURE OF GLYCOLLIC ACID. G. W. Johnson. (Deutsche Gold and Silber Scheide Anstalt vorm. Roessler.) 26,546. November 15th.

MOUNTING THE ELECTRODES OF METAL-VAPOUR APPARATUS. Hartmann and Braun Akt.-Ges. 26,747. November 17th. (December 1st, 1909.)

ELECTRIC HOUR-METER. J. Besancon. 28,884. December 12th. (Convention date not granted.)

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THERMAL ELECTRIC FIRE-ALARMS. J. W. Mowbray. 1,848. January 24th.

ANTENNAE OF WIRELESS TELEGRAPHY AND TELEPHONY. F. Bellini and A. Tosi. 2,682. February 1st. (February 10th, 1910.)

ELECTRIC FURNACES. G. V. Schatzl. 3,593. February 11th.

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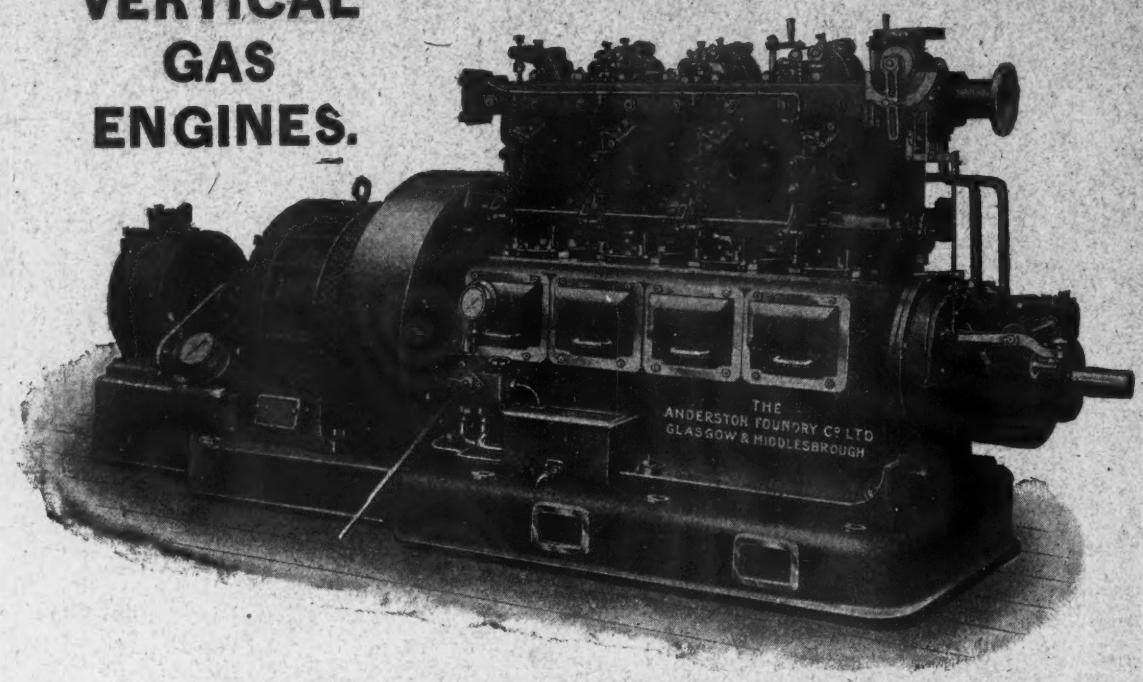

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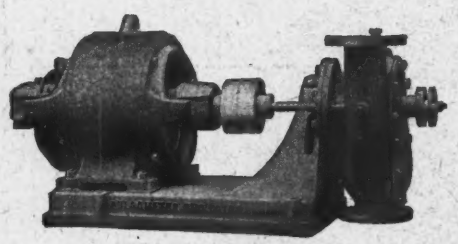

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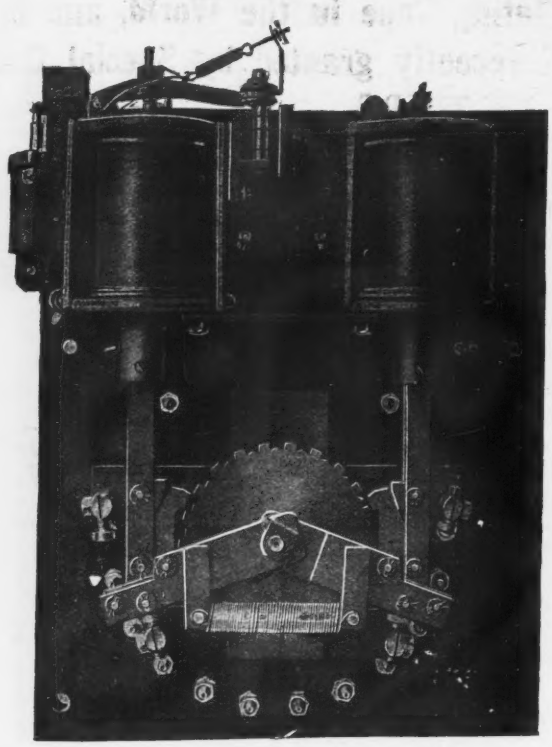

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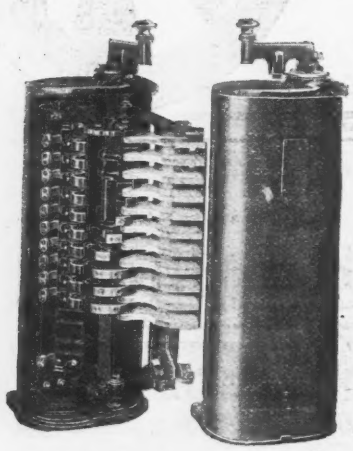

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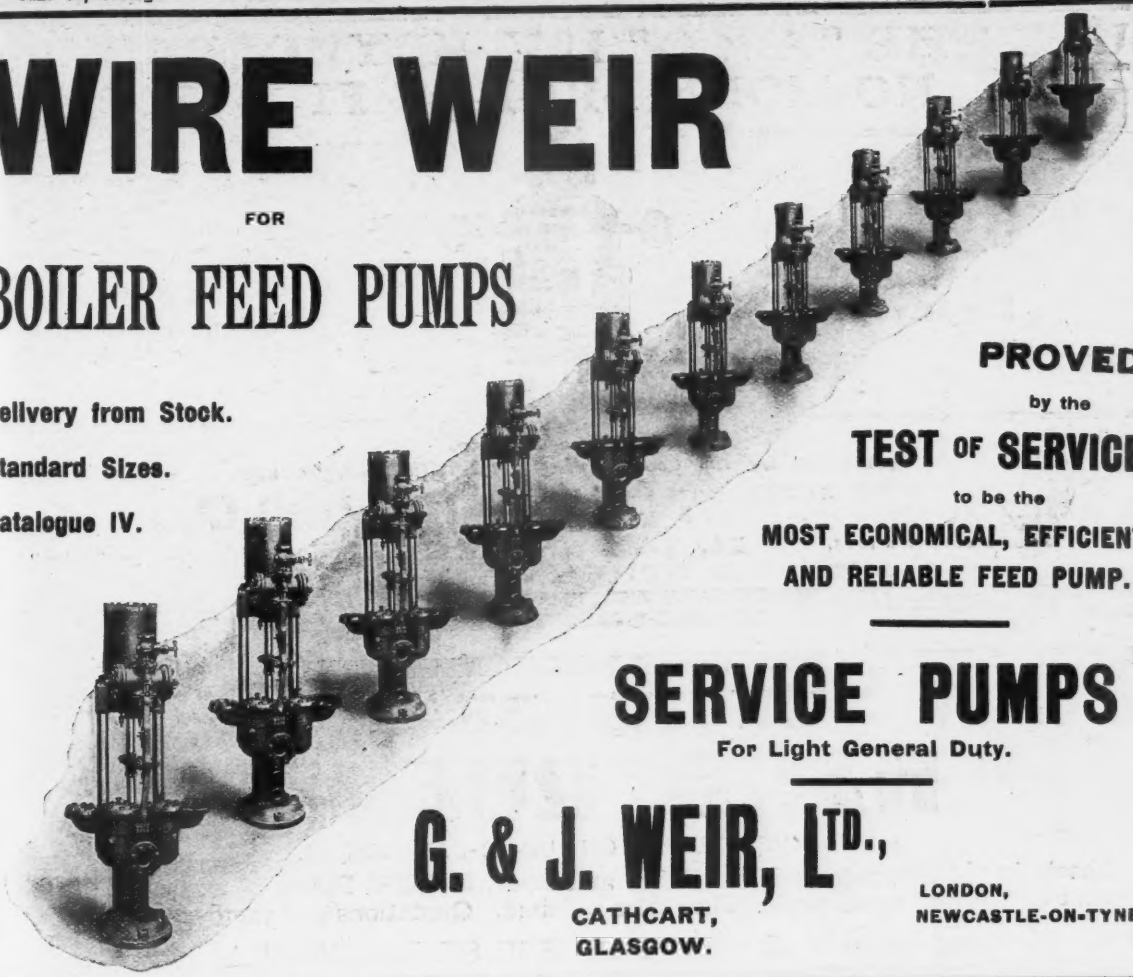

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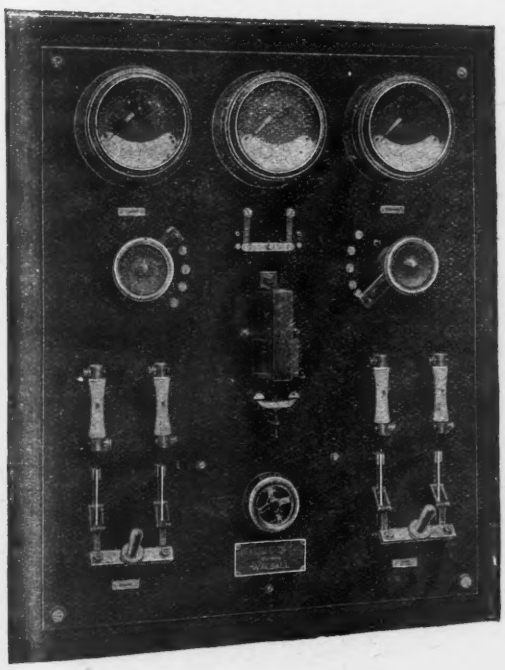

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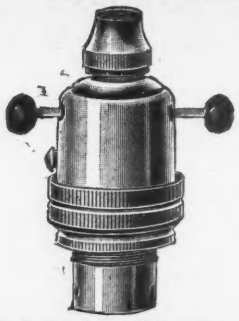

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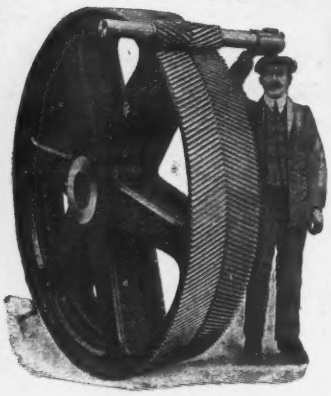

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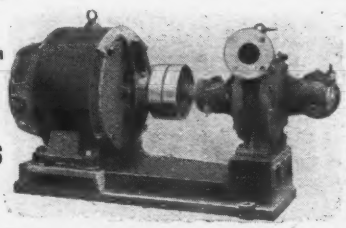

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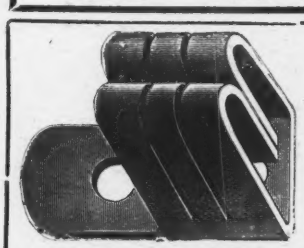

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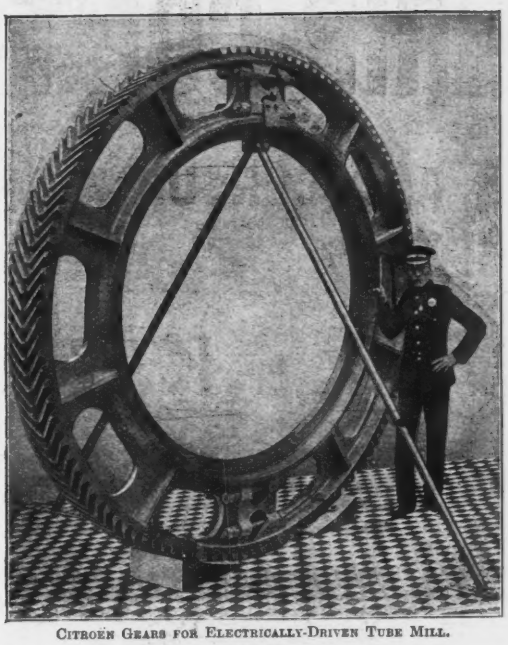

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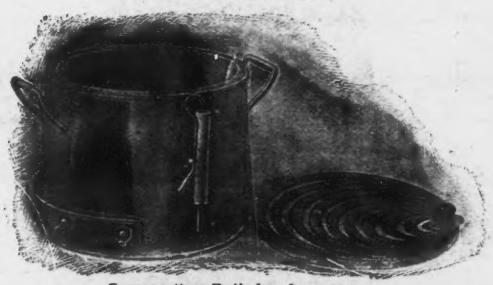

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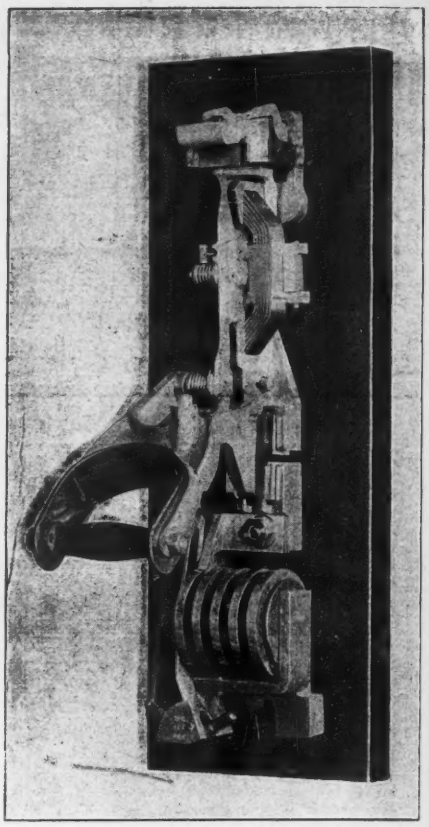
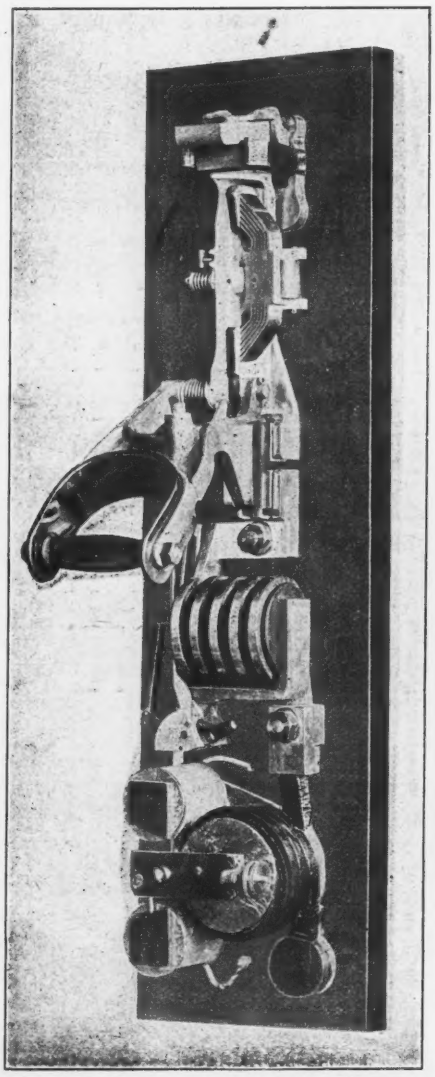


Overload Type.



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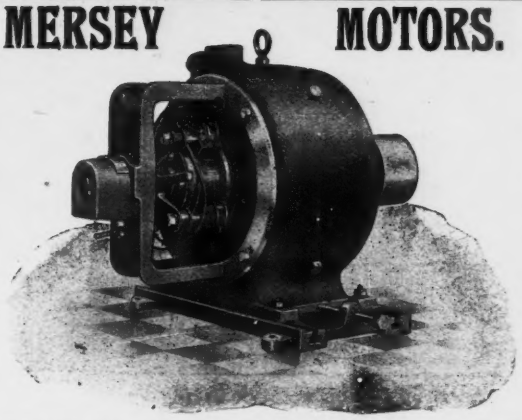

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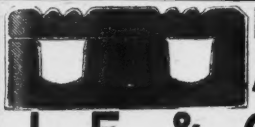

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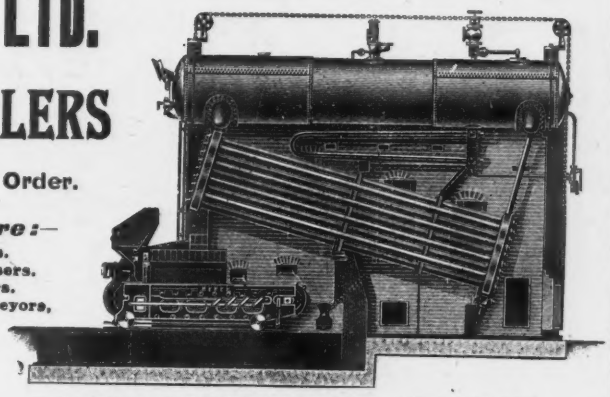

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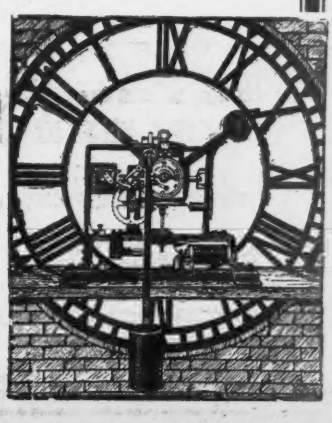

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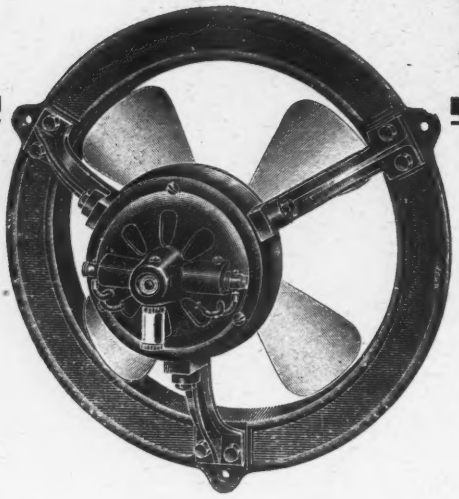

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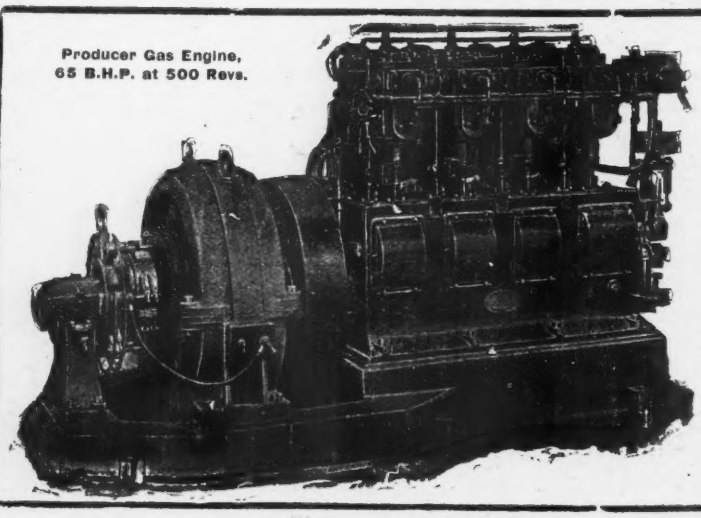

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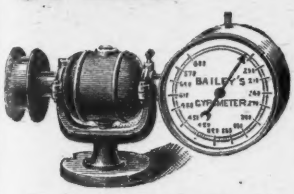

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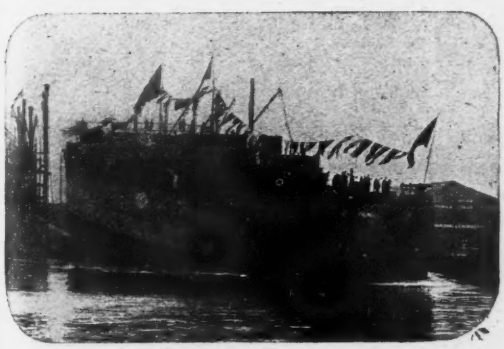

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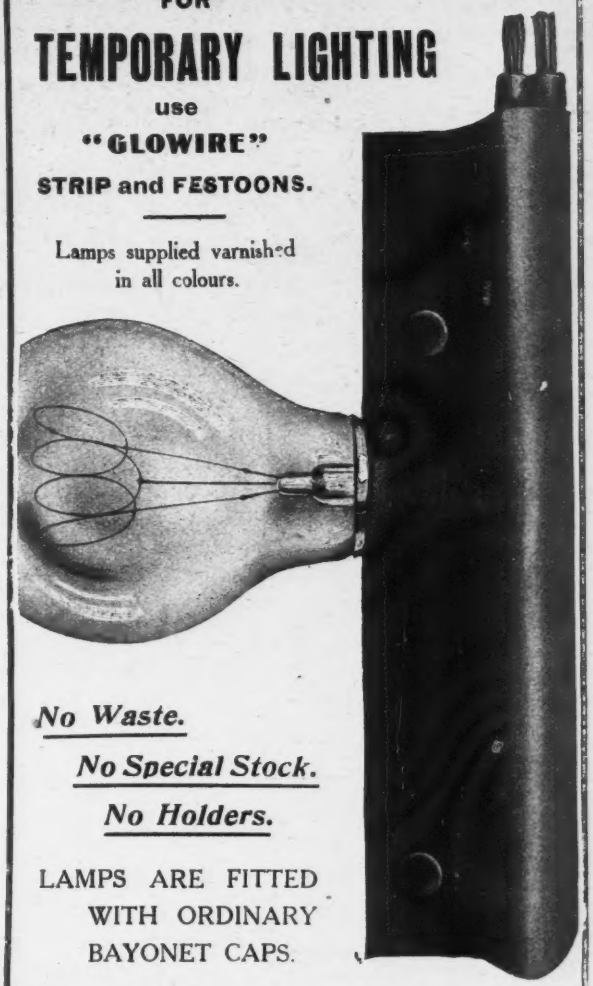

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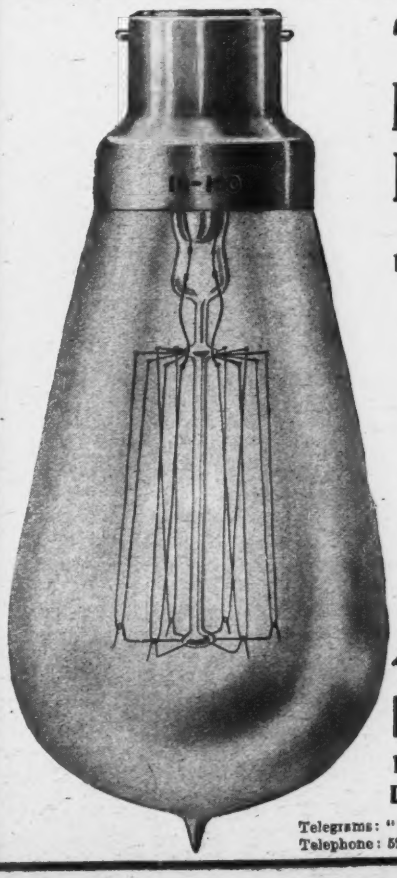

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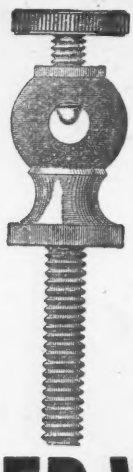

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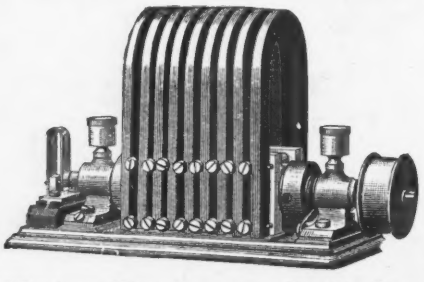

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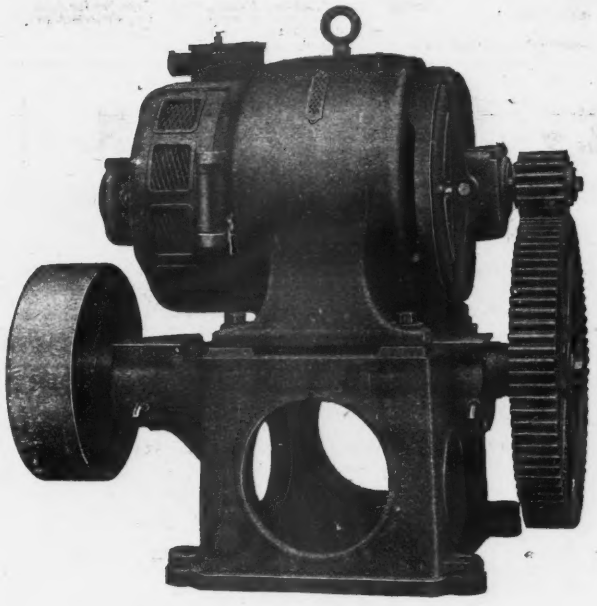

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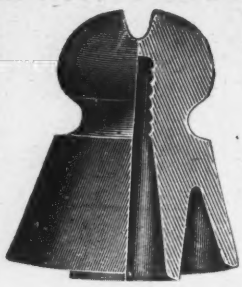

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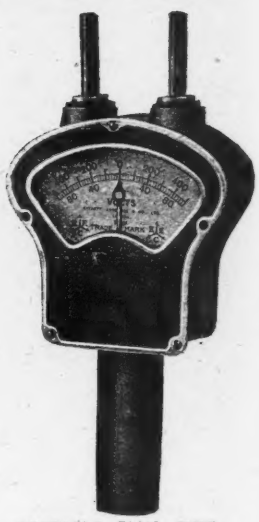

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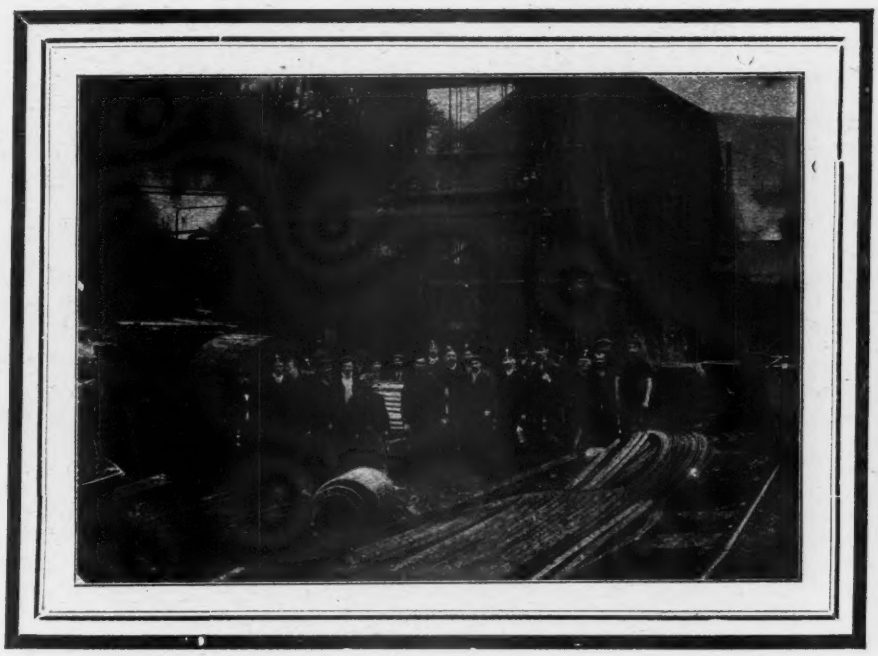

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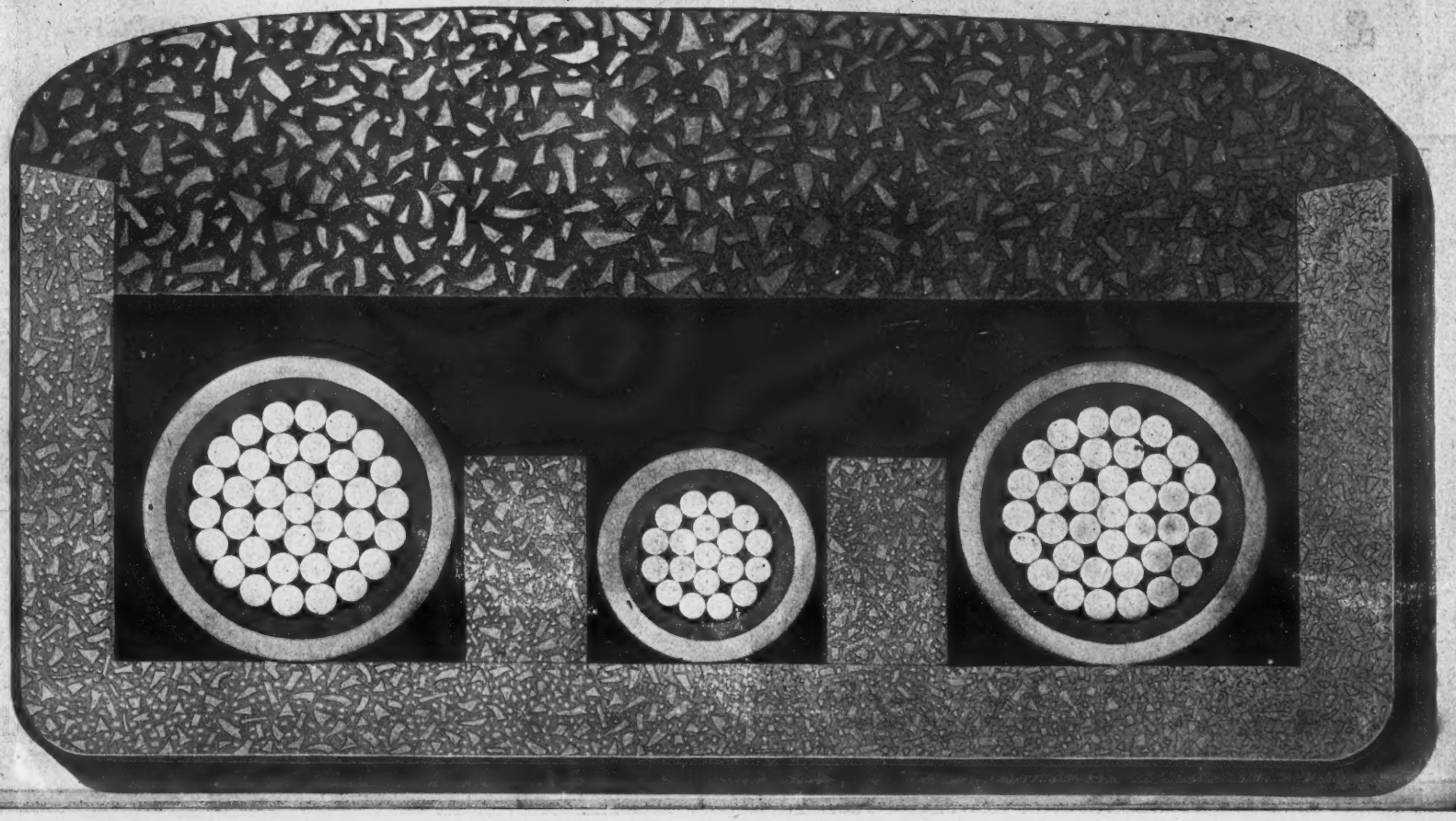

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CONTRACTORS' COLUMN.

[The following information is published in the interests of electrical contractors and others who are seeking for openings for new business. Considerable expense is incurred in the production of this column, and every care is taken to ensure that the information is new and accurate, but it will be understood that in a matter where so many correspondents are engaged, and where the amount of information to be handled is very large, this cannot always be guaranteed. If alleged inaccuracies are reported to the Editors, they will be fully investigated.]

ABERDEEN.—Workshop and showroom for Johnston Bros., cycle and motor engineers. Alterations for Reid & Pearson, drapers, 133, Union Street. Alterations for Allen & Dey, fish merchants; Brown and Watt, architects, Aberdeen. Alterations for Fishing Supply Store, Ltd.; H. Mennie, architect.

ABERYSTWYTH.—New drying house for the B.G. Probable re-erection (after fire) of saw mills, Trefechan, for D. C. Roberts.

AMBLESIDE.—Offices, Kelsick Road, for F. & A. Backhouse.

AMESBURY (near SALISBURY).—Probable re-erection (after fire) of Ivydene, boarding establishment, owned by Mr. Willis, Newport (Mon.).

ANDOVER.—Isolation hospital (£1,700); F. Beale & Sons, builders, Adelaide Road, Andover.

AYLESBURY.—Alterations to infirmary (£1,120); F. Taylor, architect, 7, Bourlon Street, Aylesbury; T. Honour & Son, Ltd., builders, Tring.

BACUP.—Car-shed for the Bacup Light Railway; J. S. D. Moffet, engineer, Tramway Offices, Mellor Street, Rochdale. Sewage scheme (£5,300) for the T.C.

BARNSLEY.—New church at Hoyland, as memorial to late J. Knowles (£2,300); Mrs. Bartlett, Greenfield House, Hoyland, donor. Extension of the public baths; Borough Surveyor.

BATH.—Developments by Stothert & Pitt, Ltd., engineers.

BECKENHAM.—Additions to Eden Hall, Albermarle Road; F. G. Crickett, architect.

BEDLINOG.—New St. Chadoc's Church; W. Dowdeswell, architect, Treharris; Jones Bros., builders, Treharris.

BEXHILL.—Motor garage, Middlesex Road, for the Frederick Hotels Co., Ltd.; J. B. Wall, architect, Devonshire Road. Pair of semi-detached houses, Collington Avenue; B. Stevens, jun., Collington Avenue. Bungalow at Norman's Bay; A. C. D. Hicks, architect, Sea Road. Addition to Ancaster House; J. B. Wall, architect.

BIRKENHEAD.—Alterations to old Library Buildings, Hamilton Street; C. Brownridge, borough engineer, Town Hall. Alterations, &c., to the Castle Hotel, Chester Street; Prescott & Davies, architects, 18, North John Street, Liverpool.

BIRKENSHAW (near BRADFORD).—Conversion of Croft House into club premises, for the Committee of the Liberal Club.

BIRMINGHAM.—Model dwellings scheme; Trustees of the late W. R. Sutton's estate.

BISHOP AUCKLAND.—Surface developments at collieries, Etherley Dene; Sir S. A. Sadler, Ltd., Middlesbrough.

BLACKPOOL.—Primitive Methodist Church at Layton.

BLAYDON (near NEWCASTLE-ON-TYNE).—New business premises at Chopwell, for Leadgate Co-operative Society.

BRADFORD.—New Royal Infirmary (£150,000 to £200,000); W. A. Pite, architect, 116, Jermyn Street, London, S.W.

BRISTOL.—Additional workhouse accommodation (£27,000); J. J. Simpson, Clerk to the B.G., Osborne House, Cotham Park, Bristol.

BROADSTAIRS.—Business premises, High Street, for D. T. Evans, chemist, High Street, Margate; R. Elliott & Co., builders, King Street, Margate.

BROCKENHURST (HANTS).—Alterations to schools; Managers, Church School, Brockenhurst.

BROOKLAND (ROMNEY MARSH).—Proposed new school, for Kent C.C.

BURNLEY.—Proposed 24 houses, Briercliffe Road (£5,280); G. H. Pickles, Borough Surveyor.

BURY.—Proposed new Wesleyan Methodist Chapel in Bolton Road; Rev. T. F. Nicholson, Superintendent Minister.

BUTTERKNOWLE (Co. DURHAM).—New Council School (200 places); W. Rushworth, architect, Shire Hall, Durham.

CAMBRIDGE.—New school, Melbourne Place (£10,800), and cookery and laundry centre, Romsey Town (£750); Borough Surveyor.

CARDIFF.—Large cold storage premises, for the Cardiff Railway Co.

CASTLEFORD (near PONTEFRACT).—Extension of workshop, Wheldon Lane, for M. Bellamy.

CHEADLE (CHESHIRE).—Laboratory, Demmings Works, for R. Clay.

CHESTERFIELD.—Alterations and additions to licensed premises, Knifesmith Gate; W. C. Jackson, architect, 29, Knifesmith Gate.

CHORLTON-ON-MEDLOCK (near MANCHESTER).—Large bakery, &c., for R. Horrocks & Sons, Ltd.; T. Tinline, builder, Park Street Saw Mills, Bury.

CHURCH (near ACCRINGTON).—Developments at Aspen Collieries; Oswaldtwistle Collieries, Ltd.

CLITHEROE.—Sanatorium for consumptives at Grindleton; Blackburn Charity Organisation Society.

CRADLEY HEATH (STAFFS.).—Women Workers' Institute, Lomey Town, with offices and large hall; A. T. Butler, architect, Priory Street, Dudley.

CROMPTON (near OLDHAM).—Theatre and music hall in Horton Street, for V. Sampson.

CROSBY (near ORMSKIRK).—Proposed refuse destructor (£1,500) and town planning scheme; J. Dean, Clerk to the Council.

DEWSBURY.—Proposed new factory at Thornhill Lees, for Messrs. Reckitts, blue manufacturers, Hull. Re-erection of woollen mill at Spinkwell; Kirk, Sons & Ridgway, architects, Market Place, Dewsbury.

DRIFFIELD (YORKS.).—Additions to the Cottage Hospital (about £600); Runton & Barry, architects.

DUNDEE.—Alterations at Belmont Works, for T. Bell & Son, Hawkhill. Mechanics' workshop and store, for Buist Spinning Co., Ltd., Stobswell Road; Manager.

DUNMOW.—Proposed public hall (£1,600).

DUNSTABLE.—Picture theatre, assembly hall and block of business premises, High Street, for the Mill Street Development Co., Luton (nearly £5,000).

EASINGTON.—Offices, for the Easington Coal Co.

EAST COWES.—New school, for the Isle of Wight C.C.; F. Newman and Cocks, architects, 5, St. Thomas's Street, Ryde.

EDINBURGH.—Mission hall in Gorgie Road, for North Morningside U.F. Church; Minister.

EDLINGTON (DONCASTER).—Surface buildings, for the Staveley Coal and Iron Co.

ELLESMERE PORT.—Elementary school (370 scholars); Secretary, Education Committee, Ellesmere Port.

ESKDALE (CUMBERLAND).—Developments by the Eskdale Mining Co.

EXETER.—Alterations and additions to bank premises, for Fox, Fowler and Co.; E. H. Harbottle & Son, architects, County Chambers, Exeter. Enlargement of Diocesan Training College (£950); J. Jarman, architect, Exeter; G. Setter & Son, builders, Old Tiverton Road, Exeter.

FALKIRK.—New premises for Camelon Co-operative Society, Ltd.; J. G. Callander, architect, 1, Newmarket Street, Falkirk.

FARNBOROUGH (HANTS.).—Additions to St. Michael's Abbey, Farnborough Road, for the Procurator.

FARNWORTH.—Opening new coal seams, &c.; A. Knowles, Ltd., colliery proprietors, Pendleton.

FARSLEY (YORKS.).—Proposed public hall (£5,000); Rev. E. B. Brown, vicar of Farsley.

GARN DOLBENMAEN.—Alterations and additions to Garn schools, for Carnarvonshire C.C.; R. Ll. Jones, architect, 14, Market Street, Carnarvon.

GOREY.—Garden City scheme (£10,000); Clerk to the R.D.C.

GLASGOW.—Buildings for the Glasgow University Officers' Training Corps.

GREAT YARMOUTH.—School at Cobholm Island; F. W. Wroughton, Secretary, Yarmouth Education Committee.

GREAT CROSBY.—Alterations, &c., at house in Liverpool Road, to form part of new parish hall; Woolfall & Eccles, architects, 60, Castle Street, Liverpool.

GUILDFORD.—Alterations to business premises, 39, High Street, for T. White Co., Ltd., chemists and druggists, Portsmouth; Rake and Cogswell, architects, Prudential Buildings, Portsmouth.

GUISELEY (YORKS.).—Probable re-erection (after fire) of portion of Ings Mill (damage over £2,000); F. W. Hobson & Co., owners; A. Maude and Son, cloth manufacturers, occupiers.

HALIFAX.—New premises for able-bodied inmates of workhouse, for the B. of G.; W. C. Williams & Sons, architects, Halifax.

HAMILTON.—New municipal offices adjoining the Library; Burgh Surveyor.

HANLEY.—Extensions in connection with St. Mark's Mission, Tinkersclough; Rev. P. Gordon, Rector of Shelton.

HASLINGDEN.—Electric light installation at the evening and secondary school (£360); Chairman, Borough Education Committee.

HEBBURN.—Offices for Hawthorn, Leslie & Co.

HEMEL HEMPSTEAD.—Alterations and additions to the Electric Theatre for Mr. Lane. Skating rink, Bury Road, for W. Greery.

HEMSWORTH (near DONCASTER).—New church girls' school; Managers.

HIGH WYCOMBE.—Additions to factory, Nutfield Lane, for Randall Bros.

HORBURY (near WAKEFIELD).—Shed at Bridge Mill, for Horbury Bridge Mills Co.

HULL.—Proposed new hospital (156 beds), with isolation wards, kitchens, &c., for the B.G.

HYDE.—Wheelwright's shop in Hammet Street, and picturedrome in Clarendon Street, for A. E Leach. Five pairs of villas and 10 houses, Oakfield Road, Newton, for C. J. Ashton's trustees.

KINGSWINFORD (near DUDLEY).—Additions to Summerhill Court, for H. S. Pitt.

LANGLEY MILL.—Extension of Wesleyan church and new school (£3,200); Rev. W. T. Coppin.

LINTHWAITE (near HUDDERSFIELD).—Alterations to shed, &c., at Longfield Dye Works, for G. Cook, Ltd. New Conservative Club premises; H. Pearce, secretary.

LIVERPOOL.—Home for sick nurses and Church Hall at Mill Road Infirmary (£4,050); West Derby Board of Guardians. Station alterations, &c., at Sefton and Maghull; L. & Y. Railway Co., Hunts Bank, Manchester. Model dwellings scheme; Trustees of the late W. R. Sutton's estate.

LLANELLY.—Proposed extensions to Market Pavilion (£2,000); G. Watkeys, Surveyor to U.D.C.

LOCKWOOD (near HUDDERSFIELD).—Detached house, Woodside Road; J. B. Abbey & Son, architects, 34A, New Street, Huddersfield.

LOFTUS-IN-CLEVELAND.—Alterations, &c., to Presbytery, for Rev. A. Gryspeert; Kitching & Lee, architects, Darlington.

LONDON (BARKING, E.).—Spotted Dog Inn to be rebuilt; the Licensee.

(BERMONDSEY, S.E.).—Warehouse, Potter's Fields, Tooley Street; Money & Johnston, architects, Anerley, S.E.; Thompson Bros., builders, 151, Queen's Road, Peckham, S.E. Club house, St. Joseph's Roman Catholic Church, Paradise Street; G. H. Wallsgrove, builder, Willow House, Willow Street, Bermondsey.

(HIGHGATE, N.).—Additions and alterations to All Saints' Church; the Vicar.

(HORNSEY, N.).—Alterations and additions to laundry, The Grove; F. Cottrell, Ltd., Crouch Hill.

(HENDON, N.W.).—Six shops, Golder's Green Road; Edmondsons, Ltd., builders, 9, Broadway, Winchmore Hill. Manse and house, Central Square, for the Hampstead Garden Suburb. Mortuary, near Council Offices (£780); S. S. Grimley, Surveyor to the U.D.C.

(SOUTHWARK, S.E.).—Building in Walworth Road (£5,000); P. Todd, architect, 22, Surrey Street, Victoria Embankment, W.C.

(CHELSEA, S.W.).—Pending additions to the Hospital for Women.

(FULHAM, S.W.).—Block of flats, Burlington Road; L. Kesteven, 11, Wolverton Avenue, Kingston Hill.

LONGTON.—Extensions and improvements by the Co-operative Society.

LUTON.—Probable re-erection (after fire) of Model Laundry, Langley Road, for W. & A. Tompkins. Additions to Vicarage, Dunstable Road, and new church room, for the Vicar of Christ Church. Picture palace, Bute Street, for the St. George's Picture Palace Co. Chemical stores, North Street, for Barford Bros.

LYTHAM (LANCS.).—Proposed extension of Children's Home; Ald. Fildes, Manchester.

MANCHESTER.—St. Joseph's R.C. Boys' Industrial Schools and workshops, Longsight, for the Christian Brothers; Messrs. Tinline, builders, Bury. Rebuilding (after fire) of premises, Oldham Street, for the United Mills Co., drapers and linen merchants (damage £6,000).

MANSFIELD WOODHOUSE.—Superintendent's house, Rescue station, for the Midland Colliery Companies' Association.

MARTIN (HANTS).—Alterations to Church of England School; G. L. W. Blount, architect, 39, High Street, Salisbury.

MATLOCK.—New Post Office in Lime Grove Avenue (£11,000—£12,000); Mr. Hopkinson, architect.

MIDDLETON.—Developments by Albany Spinning Co.

MILNROW.—New boiler and engine house, for J. Dawson, Ltd., Lower Lane, Milnrow.

MONAGHAN.—Erection of new buildings at County Infirmary; Registrar, County Infirmary.

MOORSIDE (near MANCHESTER).—Drapery shop extensions; Moorside Co-operative Society.

MORLEY.—Extensions and additions to Daisy Hill Mills, for executors of D. Hartley; T. A. Buttery, architect, Queen Street, Morley.

MOTHERWELL.—Renovation of surface buildings; Wishaw Colliery Co.

NEILSTON, N.B.—Domestic science and manual instruction building at the Higher Grade School (£1,620); Clerk to the School Board.

NEW MILLS (DERBYSHIRE).—New secondary school (200 places); A. J. Edwards, Clerk to the Governors.

NEWBURN-ON-TYNE.—Sixty houses, for the District Council.

NEWPORT (I.W.).—Additions to 15, Robin Hood Street, Barton Village, for D. S. Sibbick, grocer; Stratton & Millgate, architects, 21, Quay Street.

OLDHAM.—New St. Barnabas Church and school; Hargreaves, Rigby and Phipp, architects, Manchester.

OSWALDTWISTLE.—Additions to mill, for J. Duckworth & Co., Ltd. Working men's club premises in James Street. Proposed alterations at Town Hall; Clerk to U.D.C.

(*Continued on page* xxiv.)

PRESCOT
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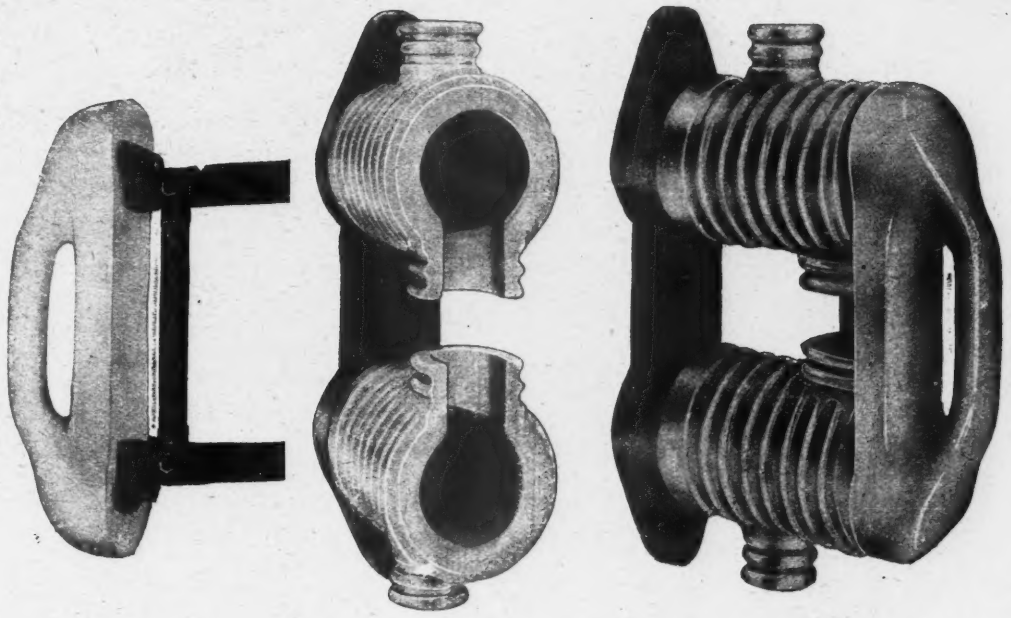

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CONTRACTORS' COLUMN.—*Continued from page xxii.*

OSWESTRY.—Proposed new almshouses; G. W. Lacey, Borough Surveyor.

OXFORD.—New buildings for Radcliffe Infirmary (£25,000); E. P. Warren, architect, 20, Cowley Street, London, S.W.

PADIHAM.—Extensions and improvements by the local Co-operative Society.

PENDLEBURY (near MANCHESTER).—Picture palace near Lord Nelson Hotel, Bolton Road, for the Benson Enterprise Co.

PENDLETON.—Developments and alterations; Pendleton Co-operative Society.

PENMAENMAWR.—New Council school at Capelulo; R. L. Jones, County Architect, 14, Market Street, Carnarvon.

PONTEFRACT.—Offices, Ropergate End, for J. H. Sykes; J. Heseltine, architect, Old Castle Drawing Office, Pontefract.

PUDSEY (YORKS.).—Yarn warehouse at Waterloo Mills; C. S. Nelson and G. Birkinshaw, architects, 15, Park Row, Leeds.

RADCLIFFE (LANCS.).—Block of houses, for the Radcliffe and Pilkington Co-operative Society.

RHYMNEY (MON.).—Congregational Church (£1,400); Habershon, Fawckner and Co., architects, Newport; W. Williams & Son, builders, New Tredegar.

RICHMOND.—Alterations and additions to 13, King Street, for Leach Bros. Alterations to Foresters' Arms, George Street; F. J. Fisher, architect, 14, Queen Street, E.C.

ROCHDALE.—Alterations to Star Hotel, Drake Street, for R. Seed and Co., Ltd., Radcliffe. New church in Castlemere Street (seat 400-450), for the Christian Scientists. Improvements and alterations, for the Eclipse Spinning Co.; and at Spotland Bridge Mills, for C. Whitaker, Ltd.

ROCHESTER.—Additions to Star Hill Almshouses; J. W. Nash, architect, 237, High Street, Rochester.

ROTHERHAM.—Extensions and alterations contemplated, Midland Railway Co.

SADDLEWORTH (near OLDHAM).—Proposed new school to replace Friezland School (240 places); Education Architect, County Hall, Wakefield.

ST. BEES (CUMBERLAND).—Residence, for F. R. Burnett; Nelson & Brindle, architects, 22, Lowther Street, Whitehaven.

SALFORD.—Secondary school for boys in Leaf Square, Pendleton (£12,000); H. Lord, architect, Deansgate, Manchester.

SCUNTHORPE (LINCS.).—New school; Scorer & Gamble, architects, Bank Street Chambers, Lincoln.

SEAHAM HARBOUR.—New upper standard school (480 places); W. Rushworth, architect, Shire Hall, Durham.

SEATON DELAVAL (NORTHUMBERLAND).—Alterations and additions to Miners' Hall; D. Robertson, The Mechanics' Institute.

SHERINGHAM (NORFOLK).—Probable re-erection, after fire, of "Roselands" (residence), for J. Dumble (damage £1,500).

SKEGNESS.—Important developments by Great Northern Railway Co.

SLAITHWAITE (near HUDDERSFIELD).—School chapel; J. H. Hall & Son, architects, "Exchange," Huddersfield.

SLEIGHTS (YORKS.).—Large villa residence, The Avenue, for Miss Close, Ripon.

SPENNYMOOR.—School at Byers Green; Curry & Walton, architects, Newcastle.

SPRINGFIELD (FIFE).—Proposed addition to Asylum (100 beds); Fife and Kinross, Lunacy Board.

STAFFORD.—Business premises, Crabbery Street; A. Andrews.

STALYBRIDGE.—Renovation, after fire, of mills; Messrs. Tattersall, Bridge Street Mills.

STAMFORD (LINCS.).—Alterations, &c., to the Conservative Club, for the Marquess of Exeter. Alterations to 62, Scotgate, for J. Frisby, senior. Alterations to 15, 16 and 17, High Street, for Colonel Costobadie.

STOCKTON-ON-TEES.—Probable re-erection, after fire, of portion of chair factory, Webster Street, for A. E. Hawkins.

SUTTON (SURREY).—Business premises, High Street, for Sir G. Smallman.

SWANSEA.—Rebuilding premises, 8, Castle Street, for E. Hosgood. Proposed school, Baptist Well Estate (400 places); A. W. Halden, Secretary, Swansea Education Committee.

SWINTON.—Additions to Chorley Road Primitive Methodist School, for the Trustees. Shop, Partington Lane, for the Worsley Brewery Co.

THORNE (near DONCASTER).—New boys' school (300 places); C. Waller, Clerk to the P.C.

TODMORDEN.—Station improvements at Walsden; L. & Y. Railway Co., Hunts Bank, Manchester.

TRURO.—Additions and alterations to the post office; L. Winn, architect, 27, Boscawen Street, Truro.

TYLDESLEY.—Improvements at mills; C. Wright & Sons, spinners and manufacturers.

WAKEFIELD.—Alterations and improvements; Wakefield Co-operative Society.

WALSALL.—Extensions, &c., by the local Co-operative Society.

WARRINGTON.—Improvements and extensions at works; Messrs. Crosfield, soap makers. Sunday schools, Friars Green; S. P. Silcock, architect, Warrington; J. Dolan & Son, builders, Warrington.

WATERLOO (near LIVERPOOL).—New Sunday Schools, for Gladstone Road Wesleyan Church, Seaforth; G. Fraser, architect, 67, Lord Street, Liverpool.

WEDNESBURY.—Extensions and improvements; local Co-operative Society.

WEST BROMWICH.—New Liberal Club; J. W. Allen, architect.

WEST HARTLEPOOL.—Shop additions and improvements, for the local Co-operative Society.

WIDNES.—Probable re-erection (after fire) of part of Copper Works, Ditton Road, for McKechnie Bros. (damage over £20,000).

WILFORD (near NOTTINGHAM).—New St. Faith's church (£6,000); Sutton and Gregory, architects, Nottingham.

WILTON (YORKS.).—New church; Mr. Charles, builder, Thornton-le-Dale.

WORDSLEY (near STOURBRIDGE).—Additions to glass works, Brierley Hill Road, for Stuart & Sons.

WYKE REGIS (near WEYMOUTH).—Probable re-erection, after fire, of residence, Buxton Road, for O. W. Warner, J.P. (damage about £3,000).

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CHAP. IV.—The Engine.
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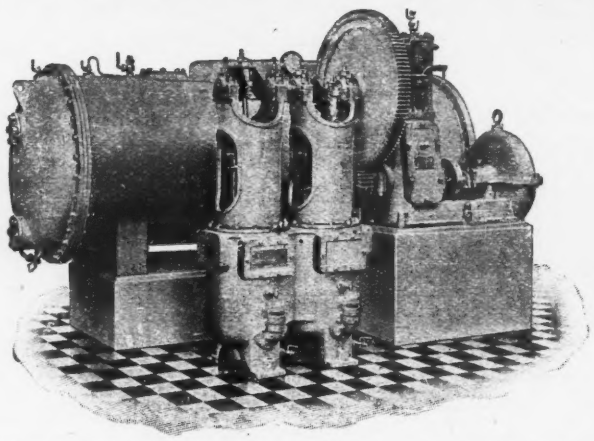

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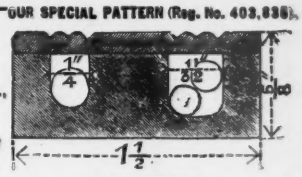

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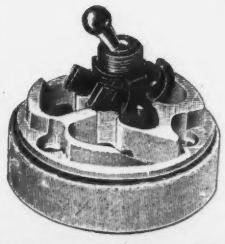

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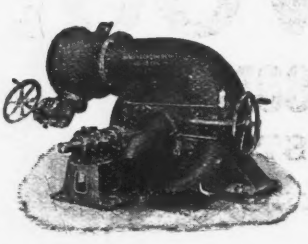

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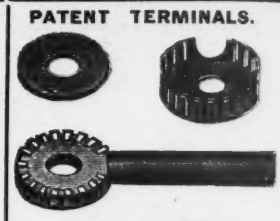

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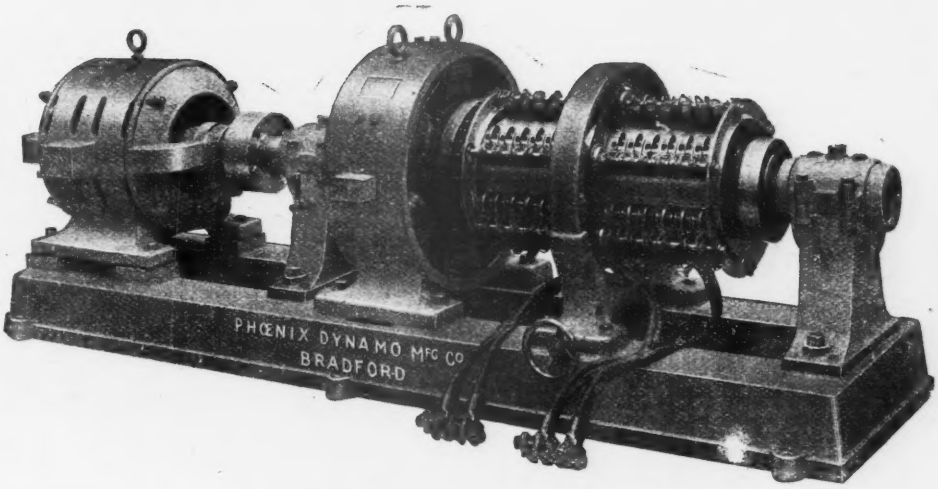

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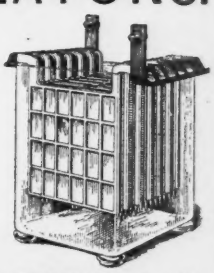

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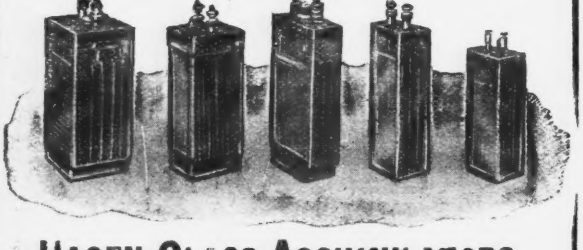

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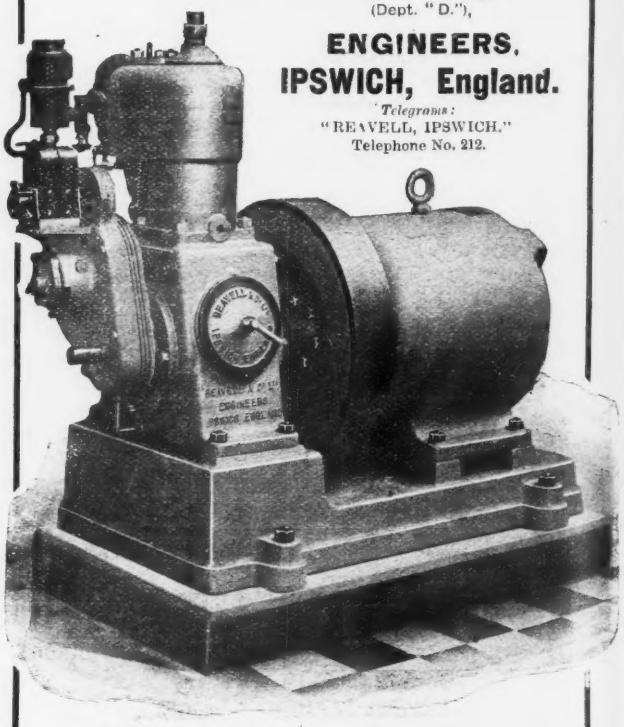

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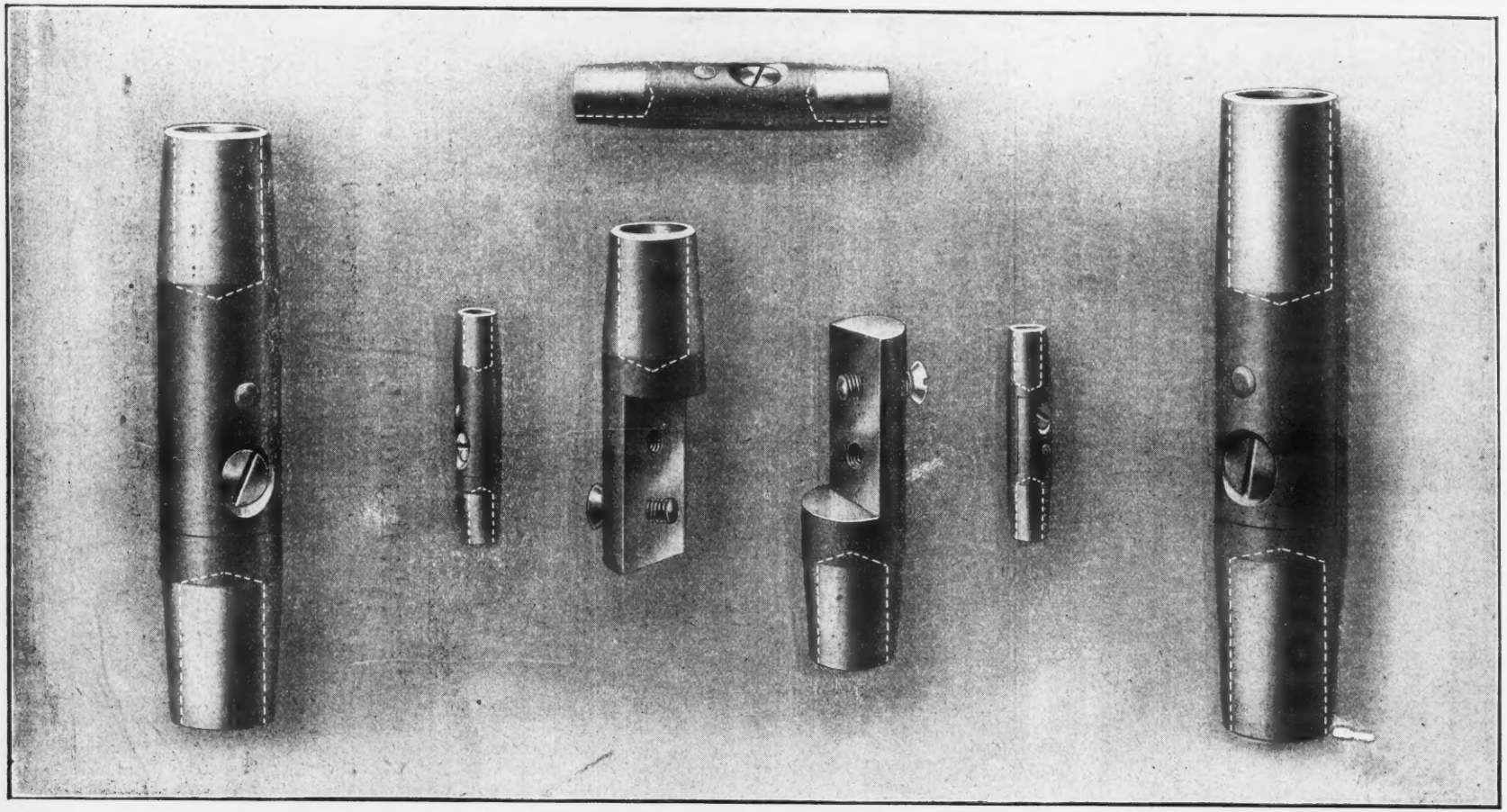

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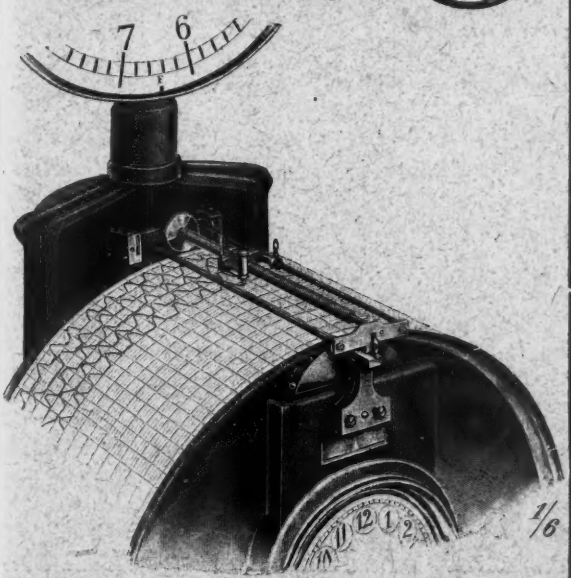

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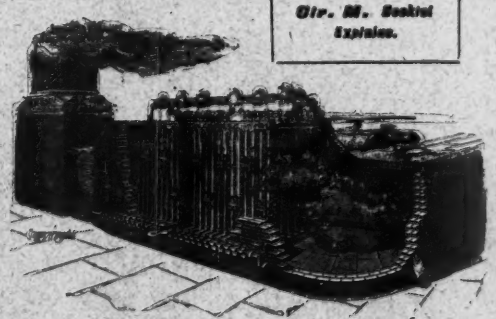

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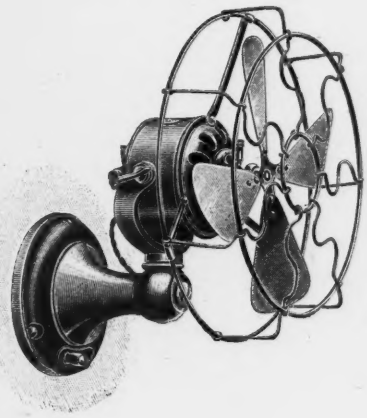

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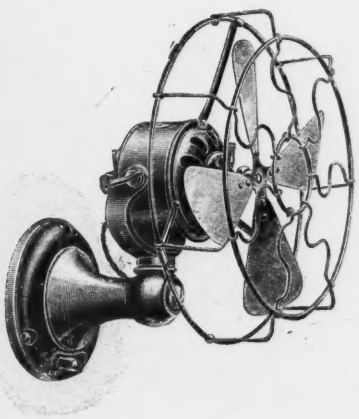

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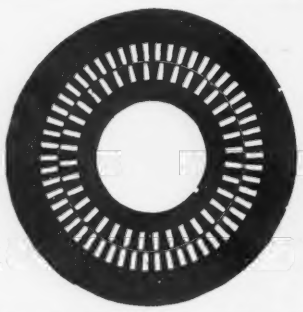

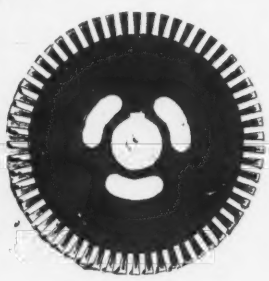

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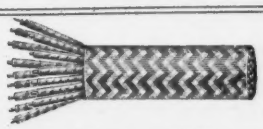

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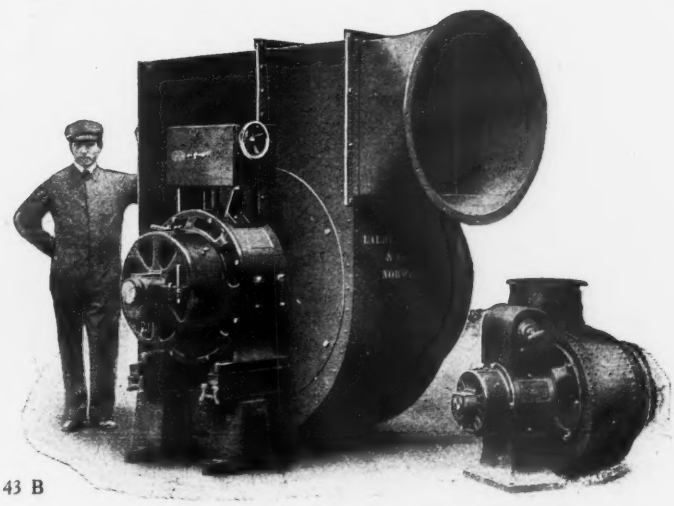

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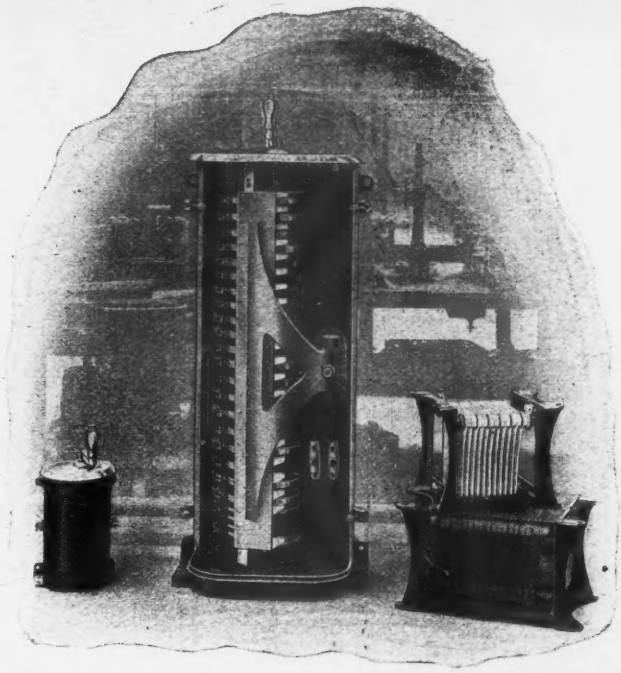

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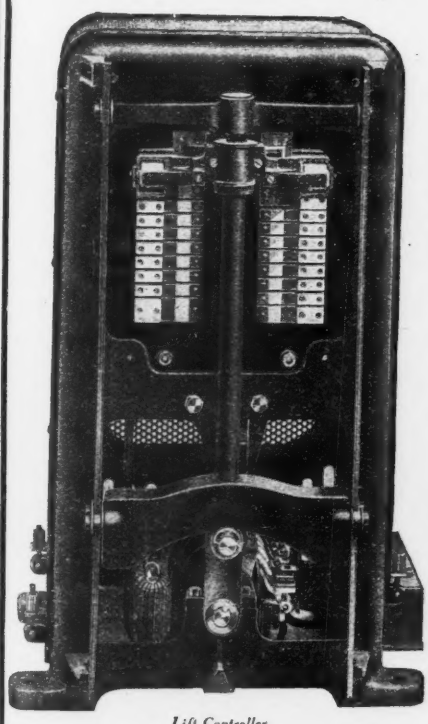

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Applicants must have successfully passed through a thorough course of electro-technical training and laboratory work at a recognised institution, and be thoroughly competent to handle, use, and be responsible for the testing equipment of an alternating current supply, testing meters and locating faults.

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THE ELECTRICAL ENGINEER,
H.M. Dockyard,
Devonport. 4093

(Continued on next page.)

SITUATIONS VACANT.—*Continued.*

REPRESENTATIVE WANTED.

THE Representation in the Birmingham District, and the Yorkshire District, and also Ireland, of one of the oldest established Incandescent Electric Lamp Manufacturing Companies is vacant.

Applications from high-class Manufacturers' Agents travelling these districts are invited.

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A FIRM of manufacturers in the North of England has vacancies for men in their instrument department for the testing of A.C., maximum current and reverse relays, wattmeters, &c. Applicants should state experience, salary required, and when they can commence their duties.—4061, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

AN Electrical Engineer with considerable experience in estimating work for large contracts, to be perfect in English and having some knowledge of German.—Apply, with references, stating salary required, to 4087, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ASSISTANT Testers or Improvers for testing electricity meters and instruments. Permanent work, good prospects suitable men.—Write details, experience, age, firms worked for, WORKS DEPT., B.T.H. Co., Rugby. 4080

CLERK (Junior) required, for consumers' department of an electrical undertaking; S.W. suburb. Previous experience desirable.—State age, wages and experience, 4064, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

DRAUGHTSMAN, Electrical, required, with experience in telephone work. Age about 25.—Apply, giving full particulars of experience, salary required, &c., to SIGNAL ENGINEER'S OFFICE, G.W.R., Reading. 4074

DRAUGHTSMAN, first-class, wanted, accustomed to H.T. and L.T. switchgear. None but thoroughly capable men need apply, by letter only, to FERRANTI, LTD., Hollinwood. 4062

DRAUGHTSMEN required immediately. Smart young men, technically trained, with some practical and drawing office experience of controllers and rheostats.—Apply, stating full experience, age, training and salary required, ADAMS MANUFACTURING CO., Bedford. 4046

DRAUGHTSMAN used to switchboard, switchgear, circuit breakers, &c.—Apply stating age, salary and full particulars, THE WALSALL ELECTRICAL CO., LTD., Walsall. 4099

ELECTRICAL Armature Winders for Glasgow, experienced in A.C. and D.C. repair work. State experience and wages. Constant employment.—4088, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

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EXPERIMENTAL Tester for electrical instruments and apparatus required. One with previous experience preferred. State age, experience and salary required. Manchester district.—4060, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

SITUATIONS VACANT.—*Continued.*

FIRST-Class Electrical Engineer required, to take charge of instrument works. Thorough knowledge of manufacture and experience in similar capacity essential. None others need apply.—4089, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

FIRST-Class Armature Winders wanted, for traction motor repairs in London district.—Apply to 4132, ELECTRICAL REVIEW, 4, Ludgate Hill, E.C.

FITTER-Driver wanted, for a small municipal electricity works in Scotland; experience of high-speed engines and Babcock boilers necessary, and preference will be given to a man possessing electrical knowledge and experience of internal combustion engines.—State full experience, age and wages required, and enclose copies of testimonials, 4121, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

FOREWOMAN wanted in filament department of electric incandescent lamp works. Must have experience and best references.—Write, giving full particulars, 3681, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

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JUNIOR Electric Fittings Salesman required by large West End firm, must be experienced.—State full particulars and salary required, to 4082, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

JUNIOR Clerk, with counting house experience, wanted; some electrical experience preferred.—Apply, stating record, copy testimonials, and salary required, 4127, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

METER Test-room Assistant required, to test, calibrate and repair electricity meters and other instruments, and generally assist in mains department.—State experience, present appointment and salary, to BURGH ELECTRICAL ENGINEER, Motherwell. 4063

REPRESENTATIVE required with connection by Electrical Engineers and Metal Workers. Assured position to right man.—Apply WAKELIN BROS., LTD., 5 & 7, Tottenham Street, Tottenham Court Road, W. 4068

SMART, Capable Working Foreman wanted, used to cheap production of motor starters and field regulators. Good prospects for live man and good organizer. State salary required.—4054, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

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SWITCHBOARD Attendant wanted, for D.C. and three-phase station; wages 25s., rising to 30s. 6d.—Apply by letter to BURGH ELECTRICAL ENGINEER, Helen Street, Govan. 4047

SWITCHBOARD Attendant wanted, experienced in three-wire station with tramway supply. Usual shifts. Wages 25s. per week.—Applications with copies of testimonials to CITY ELECTRICAL ENGINEER, Carlisle. 4081

SWITCHBOARD Attendants.—The London County Council invites applications for positions of Switchboard Attendants for tramways sub-stations. Shift duties. Wages, 30s. a week, rising to 35s. Applicants must have practical knowledge of switchboard operation and be not less than 22 years of age.—Apply to the CHIEF OFFICER OF TRAMWAYS, London County Council, 62, Finsbury Pavement, E.C. 3857

TELEPHONES.—Capital opening occurs for young Electrician on large private installation being erected. Telephone experts have exceptional prospects. Premium required.—"ELECTRIC," 27, Corporation Street, Manchester. 4108

(Continued on next page.)

SITUATIONS VACANT.—*Continued.*

THE Cleveland & Durham Electric Power, Ltd., require a Shift Engineer for one of their power stations; Wages £2 5s. per week. Experience in a high-tension three-phase generating station is essential, and preference will be given to those who have served an apprenticeship in a general engineering works.—Applications with particulars as to age and experience, together with copies of testimonials, to The SECRETARY, Hintons' Buildings, Middlesbrough. 4106

TOWN Traveller for firm of manufacturers of electrical specialities wanted. Must be first class man and well connected amongst wholesale and export firms. Send copies of references and state salary, 4100, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED at once, Switchboard Attendant for three-wire D.C. station near Glasgow. Wages £1 per week.—Apply, stating age, experience, &c., to 4056, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, by Electrical Contractors, a smart Traveller, known to builders and shop managers. Liberal commission on results.—4045, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, first-class Salesman for Birmingham district, and another for Manchester district, to sell Metal Filament and Arc Lamps, also Electrical Accessories. Only salesmen with good live connection will be considered. Good opportunity for right man. State age, experience, present employment and salary required, in confidence.—Apply 4057, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, Working Electrical Engineer to take charge of electric plant in works, London district. Must have thorough knowledge of wiring both for light and power; able to carry out extensions, &c. Man with good mechanical experience preferred.—Apply 4058, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, by an old-established firm of electric incandescent lamp manufacturers (carbon and metal), a qualified Representative for the London district.—Apply 4085, ELECTRICAL REVIEW, 4, Ludgate Hill, London, with all particulars and salary expected.

WANTED, by a firm of electric incandescent carbon lamp makers, a skilled Foreman for the stem, depositing and flashing departments, and with experience in the manufacture of micro and telephone lamps.—Apply, stating experience and wages, to 4084, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED a skilled Assistant Engineer for Electric Incandescent Lamp Factory with experience in the manufacture of Carbon and Metal Lamps.—Applications (which will be treated as strictly confidential), stating full particulars, age, salary required, &c., to 4086, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, first-class Test-room Assistant, fully competent to take charge of testing and calibrating motor starters and regulating apparatus of various kinds.—State experience, age and wages required, to 3937, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, one or two first-class Switch Hands, used to assembling motor starters and controllers; must have had experience with small switch gear and resistance apparatus of various kinds.—Write, stating fully particulars, to 3938, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

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APPLICANTS for the post of Assistant Engineer for tramway system, advertised in 3960, are thanked, and informed that the position is now filled. 4066

FITTER-Driver Manx Electric Railway. Applicants are thanked, and informed that the post has now been filled. 4067

PROVINCIAL Cinematograph Theatres thank applicants for the post of Electrician, and hereby inform them that the vacancy has now been filled. 4083

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A COMPETENT Electrical Engineer (30), now Resident Engineer (tramways) desire re-appointment, or to Assistant on large concern. Experienced central station manager. Mains and commercial, lighting, tramways and railway experience.—3984, ELECTRICAL REVIEW 4, Ludgate Hill, London.

ADVERTISER (32) seeks post, 15 years' electrical engineering experience with leading firms; good education, smart appearance; prepared to represent engineering firm. Moderate salary.—4094, ELECTRICAL REVIEW 4, Ludgate Hill, London.

ADVERTISER (age 30), requires charge of plant or installation work; highest references; late Royal Navy.—Write, stating salary, WESTWOOD, 24, Gascony Avenue, Kilburn. 4097

ADVERTISER, central station, contracting, commercial experience, desires to represent first-class firm in Birmingham and Midlands. Well known in district.—4105, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

AN Electrician, thorough practical and theoretical, seeks engagement on country estate plant. Steam engine or turbine or water, accumulators, bells, maintenance and general repairs. River electric launch work a speciality. Wages required according to responsibilities.—JOHN WEST, 19, Fowell Street, North Kensington. 4052

CLERK (25), desires change. Ledger costing, wages, &c. Good experience.—3976, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

CLERK, specialist railway rates, experienced manufacturers wages.—4036, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

DRAUGHTSMAN experienced, 11 years switchboards, switchgear, Admiralty work, neat, accurate.—4053, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICAL Engineer with wide experience in the most successful economical running and maintenance of large modern power stations (turbines and reciprocating engines), seeks appointment where a live energetic resident engineer or assistant is required.—4095, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICAL Fitter (32), can take charge of Electrical Installation, bench, wiring, winding, 7½d.—ERBACK, Buckingham. 3913

(Continued on next page.)

SITUATIONS WANTED.—*Continued.*

ELECTRICIAN (28) requires permanency or working partnership in electrical firm; good refs. and experience, technical knowledge.—3977, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICIAN desires charge of country plant; lighting, bell, telephones, &c. Age 27.—55, Altmore Avenue, East Ham, E. 3910

ELECTRICIAN (Mechanic), for an estate, requires berth; knowledge of motor cars; slight driving experience; married. —ELECTRICIAN, 207, Munster Road, Fulham. 4136

ELECTRICIAN (young) disengaged; lighting, 'phones, bells, motors, &c., refs.—4070, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICIAN Improver (22), six years' good experience in motors, arcs, bells, telephones and general lighting, have served apprenticeship, excellent reference, 7d.—PYEFINCH, 60, Yalding Road, Bermondsey. 4111

ENGINEER-in-Charge of 5 years' standing; has also carried out steam and electrical contracts up to £4000; commercial training, age 37, desires change.—4120, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

EXPERIENCED Mining Electrical Engineer, A.M.I.E.E., desires change, assistant or charge; D.C., A.C. experience.—Full particulars on application, 3968, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WIREMAN wants job, any distance.—T., 71, Vernon Avenue, Raynes Park, S.W. 3992

WIREMAN, disengaged, 14 years' experience.—G. H., 14, Sterndale Road, West Kensington. 4043

WIREMAN (town or country), disengaged; light and power; references.—E.C., 35, Valentine's Road, Ilford. 4096

WIREMAN wants job, young, experienced.—SPEED, 13, Ladbroke Crescent, London, W. 4072

WIREMAN, good refs., distance no object: total abstainer.—ELECTRICIAN, 81, Seventh Avenue, Manor Park. 4051

YOUNG Man wishing to learn electrical work, in or near London, will give services for board or small salary. Slight knowledge. Good references.—4075, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

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MECHANICAL and Electrical Engineer.—An opening occurs in a well-established firm in Australia for the above. It would be necessary to take a pecuniary interest in the concern to the extent of £4,000 to £5,000, and charge of engineering departments. Salary and interest on capital guaranteed.—3929, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

PARTNERSHIP.—Vacancy occurs in small electrical engineering company manufacturing very high class electrical machinery, for Partner, with £2500 to £3000, as Managing Director, to take entire management of factory. Direct current machinery.—Apply in first instance to PARTNER, *E. A. Daily Times* Offices, 149, Fleet Street. 4069

PARTNERSHIP or position, moderate capital, by capable energetic person, long experience organising and in charge of workshops turning out large quantities electrical machinery, instruments and apparatus.—3999, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

PARTNERSHIP.—A.M.I.E.E., A.M.I.Mech.E., with London offices, works, capital, &c., and several patent specialities, including wonderful new wiring system, absolutely the simplest, cheapest and safest, now selling splendidly, wants another, with £500 to £1,000, for own use, to join him and manage branch. Fine opportunity, brilliant prospects and no risks.—AMP., 11, Pratt Street, N.W. 4035

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WHOLESALE House with live connections in Lancashire, Cheshire, Yorkshire, Durham and Northumberland, is open to represent Manufacturers on area to be agreed upon.—3934, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

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TWO 200 KW. Sissons-Bruce Peebles Generating Sets, 220 volts, 350 R.P.M.
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150 KW. Generating Set, three-crank compound engine, generator 230 volts, 652 amps., 390 revs.
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(Continued on next page.)

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ACCUMULATORS, Second-hand, any type, wanted; also Dynamos and Machinery, Lead Peroxide, Old Copper Cable, Scrap Metals, and every description of Metallic Dross purchased for cash, town or country.—Write A. BROWN & SONS, 142, Lower Clapton Road, N.E. Telephone: Dalston 555. 9013

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MISCELLANEOUS.

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THE PROPRIETOR of British Patent No. 18,322 of 1904, relating to the Electric Lighting of Railway Trains, is desirous of entering into arrangements with British manufacturers with a view to the Sale or commercial exploitation of the invention—protected by the above Letters Patent.

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THE Owners of British Patent No. 14581 of 1906, entitled "Improved Apparatus for the Automatic Distribution of the operating service in Telephone Exchanges," are desirous of disposing of the Patent or entering into a working arrangement under License with firms interested in the same. The Invention is of particular interest to Telephone Companies and those engaged in the manufacture of Switchboards where a uniform distribution of the operating service is required.—For further particulars address Box 134, PATENTS WORKING DEPARTMENT, TECHNICAL PUBLISHING COMPANY, 19, Southampton Buildings, London, W.C. 4126

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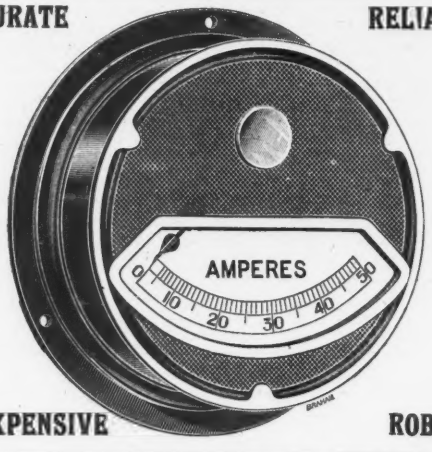

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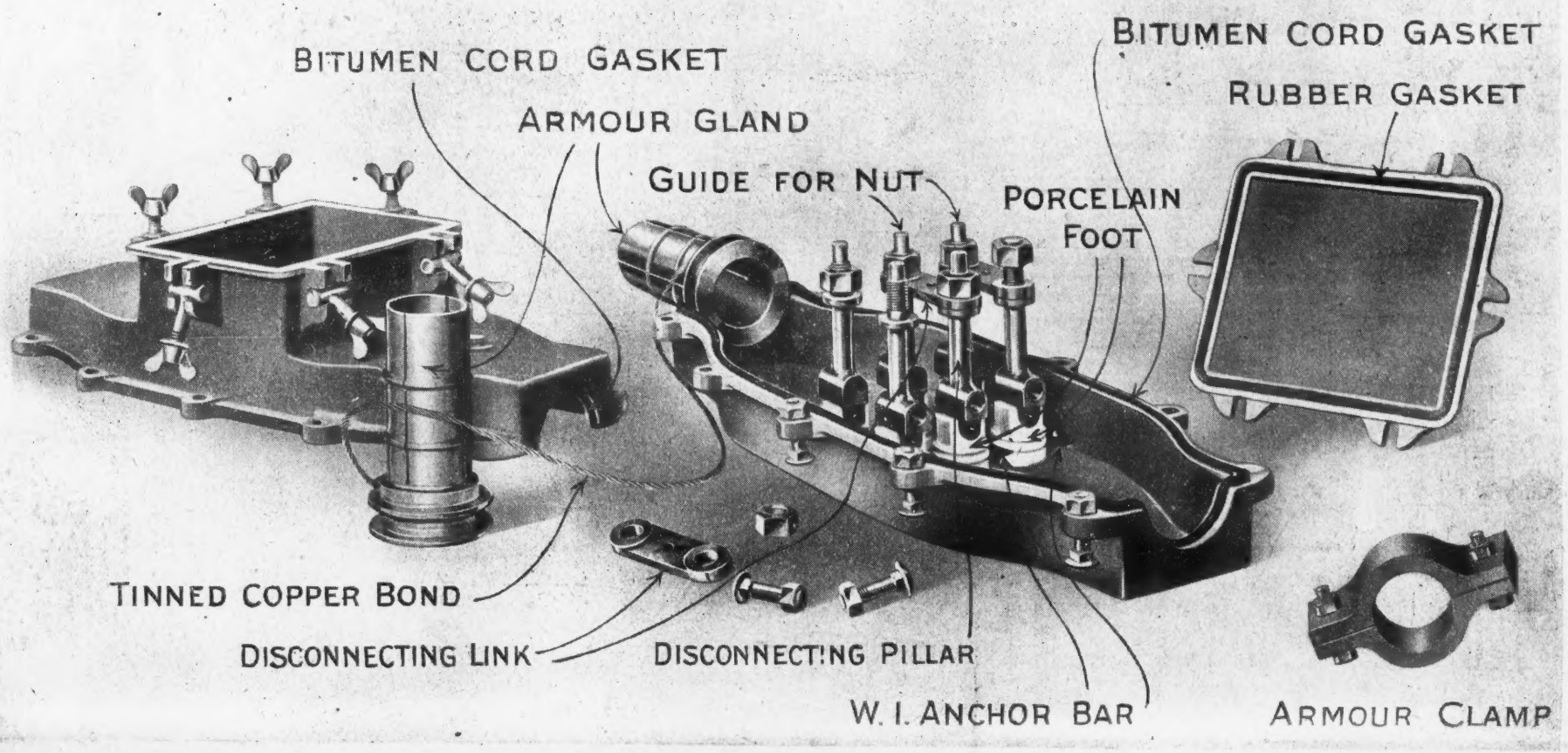

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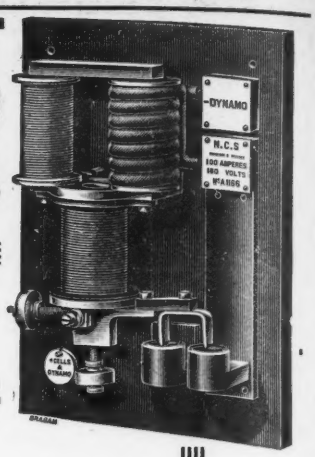

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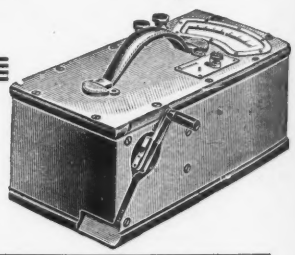

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OFFICIAL NOTICES.

Latest time for receiving, 9.30 a.m. Thursday.

ARON ELECTRICITY METER, LTD.

AT THE MEETING of this company held on TUESDAY, JUNE 20th, at Winchester House, E.C., Mr. H. HIRST, who presided, said:

Gentlemen, I take it that you have read the Report and Balance Sheet as presented to you. I hope you have looked at the figures with the same amount of pleasure that they have given to your Directors; they show the healthy development and progress of our business. Comparing this year's report with last year's, I single out the following items for comment:

First, the most interesting item of gross profit on trading amounting to over £44,000. This is nearly £9,000 in advance of last year, and nearly every branch in every country has contributed to this pleasant result. The amount received from dividends on investments is reduced, owing to the fact that the expansion of our business drained our liquid reserves to the utmost previous to our Debenture Issue. We had to realise these reserves during the year, and, I regret to say, at a loss. No blame can be attached to your Directors for this loss, as we kept these reserves in trust securities, and you are all familiar with the fact that all trust securities in this country have receded in their value to an unpleasant standard. Whatever the causes may be it is not for us to discuss here, but we must realise the fact. I refer to it not only on account of the items on the debit side of the Profit and Loss Account, namely, £78 and £85, but more on account of the fact that we have had on a previous occasion to write trust securities down by an amount of between £700 and £800.

On the debit side of the Profit and Loss Account I wish to point out that we have depreciated this year more by about £1,600 than last year, and the additional expenses are due to the recent Debenture Issue, which necessitated calling in the old debentures, and paying the premium on them. The management charges are of course increased, but not out of proportion to the increased business.

As regards the figures on the Balance Sheet, on the Credit side we have increased stock and outstanding accounts, but your Directors are satisfied that the increase is normal in proportion to the increase of business. The large amount of cash at our disposal is, of course, the residue of the recent Debenture Issue.

On the Debit side of the Balance Sheet I would like to refer to the increased nominal capital. We have not issued any additional capital, we have only asked for the power to do so. This was a necessary provision to meet the possible—I may say probable—desire of the new Debenture Holders in due course to avail themselves of their option of converting their Debentures into ordinary shares.

I am happy that we are at last in a position to pay a dividend to the Ordinary Shareholders, and I personally thank them for the patience they have shown. I think the outlook is such that they may enjoy continued participation in our prosperity. We shall continue to be conservative in our policy, and I hope you approve of our recommendation to put £5,000 to Reserve Account and use £7,000 of this year's profits in writing off a portion of the costs of the Debenture Issue. I personally hope and think I am justified in doing so, that the profits we are now making may continue, and that the business we have established may prosper further to enable the Directors to distribute in the future satisfactory dividends to both classes of shareholders.

As regards the business itself, there is very little new to say. The meter business is carried on on the same lines as before; our increased output has strengthened our power to compete in the world's markets; our organisation, thanks to the supervision and hard work of Prof. Aron, is being more and more perfected every year, and the loyalty and interest in the business of our staff is an asset of which we can be proud. Concerning the Taximeter business, we are pleased with the ever-increasing number of instruments that are being placed on the streets. It may be pleasant news to the shareholders to learn that we have hitherto used the total revenue from this branch of our business towards writing down the expenses and cost of the instruments which we hire out, and none of the revenue has so far been used in arriving at the figure which we record as our trading profit. By this conservative policy we hope in years to come to create a valuable annual contribution towards the dividends we hope to pay. I shall be glad to answer any questions that you may wish to put to me, and I have now much pleasure in moving that the Report and Accounts of the year to the 31st March, 1911, as circulated among the shareholders, be received and adopted.

SIR J. PENDER, Bart., seconded the motion.

The CHAIRMAN, replying to a question, said that the Company recently formed for the better administration of the taximeter business, was practically a subsidiary concern. They held all the shares, and any profits would come to them.

The report was adopted.

CITY AND COUNTY BOROUGH OF BELFAST.

Tramways and Electricity Department.

THE TRAMWAYS AND ELECTRICITY COMMITTEE of the Belfast Corporation are prepared to receive Tenders for the Supply of—

A CIRCULATING WATER PUMP
and
A MOTOR-DRIVEN AIR PUMP.

Specifications, with Form of Contract, may be obtained from Mr. T. W. BLOXAM, City Electrical Engineer, East Bridge Street, Belfast, on deposit of One Guinea for each Specification. This deposit will be refunded, provided a *bona fide* tender has been sent in, and not withdrawn.

Extra copies may be obtained at 10s. each, which sum will not be returnable.

Sealed Tenders, endorsed "Tender for Circulating Pump," or "Tender for Air Pump," to be lodged in my office, not later than 10 a.m. on MONDAY the 17th JULY, 1911.

The lowest or any Tender not necessarily accepted.

A Tender if sent by post must be registered; if delivered, an official receipt must be obtained for it, otherwise the undersigned will not be responsible.

R. MEYER,
Town Clerk. 4065

OFFICIAL NOTICES.—*Continued.*

ELECTRICAL EXHIBITION, OLYMPIA,

SEPT. 23rd TO OCT. 21st, 1911.

THE EXECUTIVE COMMITTEE of the above Exhibition will be glad to receive estimates for an Electrical Sign to be fixed outside Olympia for use during the period of the Exhibition.

Estimates giving suggestions as to the form, and other particulars, suggested by the Tenderer should be addressed to the Chairman, Executive Committee, Electrical Exhibition, Olympia, 1911, Broad Street House, E.C., and must be sent in on or before JULY 10th.

4048

URBAN DISTRICT OF REDDITCH,

ELECTRICITY DEPARTMENT.

THE DISTRICT COUNCIL is prepared to receive Tenders for the following Plant:—

1.—Single-phase Alternator to be direct coupled to a Willans Steam Turbine.
2.—Condensing Plant.
3.—Pipework.

Specifications and Forms of Tender can be obtained from the undersigned on payment of a deposit of One Guinea, which will be returned on receipt of a *bona fide* Tender.

Sealed Tenders to be delivered to MR. GEORGE W. HOBSON, Clerk to the Council, on or before 5 p.m. on MONDAY, the 10th day of JULY, 1911.

WM. J. FERGUSON,
Engineer and Manager.

Electricity Works,
Redditch,
June 24th, 1911. 4059

BOROUGH OF STOCKTON-ON-TEES.

ELECTRICITY WORKS.

THE CORPORATION OF STOCKTON-ON-TEES invite Tenders for the supply, delivery, and erection of the following supplementary plant at their Electricity Works:—

Section 10.—Switches, Cut-outs, Instruments, &c., on Main Switchboard.
" 9.—Addition to existing Cooling Tower.
" 11.—One Superheater and one Feed Water Meter.
" 12.—Wrought and cast Steam and Exhaust Pipes and Valves.

Specifications and Forms of Tender for the respective sections may be seen at the office of the Borough Electrical Engineer, Mr. J. J. SMITH, Electricity Works, Stockton-on-Tees, or obtained from him on receipt of application accompanied by the fee of One Guinea, which will be returned on receipt of a *bona fide* Tender.

Sealed Tenders, endorsed according to Section and addressed to the undersigned, must be delivered at the Borough Hall, Stockton-on-Tees, not later than 12 noon on JULY 11th, 1911.

The Corporation do not bind themselves to accept the lowest or any Tender, and the acceptance of the selected Tender will be subject to the sanction of the Local Government Board being received to the necessary loan for the works.

ARTHUR B. CROSBY,
Town Clerk.

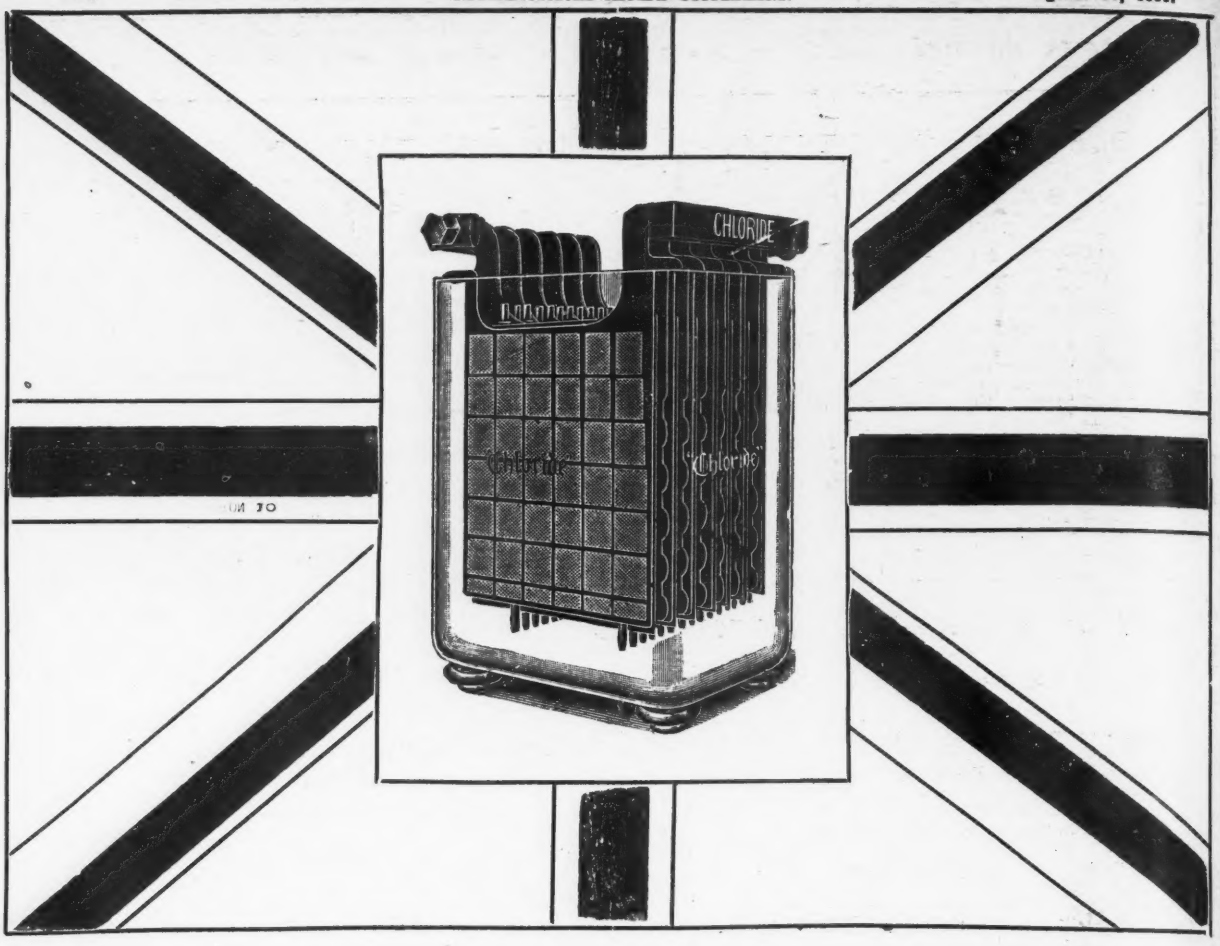
Borough Hall,
Stockton-on-Tees,
June 26th, 1911. 4110

COUNTY BOROUGH OF SALFORD.

TENDERS required by 12 noon, 17th JULY, 1911, for One Water Tube Boiler complete with Superheater.

Full particulars from BOROUGH ELECTRICAL ENGINEER, Electricity Works, Frederick Road, Pendleton. 4102

(*Continued on page* 21).



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LONDON OFFICE: 39, VICTORIA STREET.

OFFICIAL NOTICES.—*Continued from page* 19.

BURGH OF COWDENBEATH.

To Makers of Diesel Oil Engines.

THE PROVOST, MAGISTRATES AND COUNCILLORS of the Burgh of Cowdenbeath, invite Tenders for the Manufacture, Supply and Erection of one Diesel Oil Engine and Continuous-Current Generator.

Copies of the Specification and Conditions of Contract can be obtained on application to Mr. JAMES S. RAE, Burgh Surveyor, Town House, Cowdenbeath.

Sealed Tenders on the prescribed Form, endorsed "Generating Set," should be lodged with the Subscriber not later than 12 o'clock (noon) on the 10th JULY, 1911.

The Town Council do not bind themselves to accept any offer.

(Signed) GEO. TERRIS,
Town Clerk.

Town House,
Cowdenbeath,
June, 1911. 4104

CITY OF MELBOURNE, AUSTRALIA.

Supply of Bare Hard-drawn Copper Cable.

TENDERS are invited for the Supply of 4 tons 6 cwts. Bare Hard-drawn Copper Cable.

Specification, Tender Form and Conditions of Tender, can be obtained on application to the undersigned.

Such application must be accompanied by a deposit of 5s., which will be returned on receipt of a *bona-fide* tender.

Tenders to be endorsed "Tenders for Bare Hard-drawn Cable," and must be received by the undersigned not leter than 12 noon of TUESDAY, 18th JULY, 1911.

The Council reserves to itself the right, but does not bind itself to accept the whole or any portion of a Tender.

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London, E.C.
Agents for Melbourne City Council. 4116

CITY OF MELBOURNE, AUSTRALIA.

Supply of Incandescent Electric Lamps.

TENDERS are invited for the supply of 35,700 Incandescent Lamps.

Copies of Specification, Forms of Tender and Contract, &c., can be obtained, on written application to the undersigned.

Such application must be accompanied by a deposit of 5s., which will be returned on receipt of a *bona-fide* tender.

Tenders to be sent to the undersigned endorsed "Tenders for Incandescent Electric Lamps," and must be received by them by noon of FRIDAY, 21st JULY, 1911.

The Council do not bind themselves to accept the lowest or any Tender.

McILWRAITH, McEACHARN & CO., PROPY., LTD.,
Billiter Square Buildings,
London, E.C.
Agents for Melbourne City Council. 4117

OFFICIAL NOTICES.—*Continued.*

COMMONWEALTH OF AUSTRALIA.

Postmaster-General's Department,
15*th May*, 1911.

TENDERS are invited up to the 9th August, 1911, for the supply of 4 Motor Cars (Petrol) complete, to the Postmaster-General's Department in South Australia.

Tender Forms and Specifications may be obtained at the Commonwealth Office, London.

JOSIAH THOMAS,
Postmaster-General. 4049

COMMONWEALTH OF AUSTRALIA.

Postmaster-General's Department,
15*th May*, 1911.

TENDERS are invited up to the 9th August, 1911, for the supply of Letter Box Fronts to the Postmaster-General's Department in South Australia.

Tender Forms and Specifications may be obtained at the Commonwealth Office, London.

JOSIAH THOMAS,
Postmaster-General. 4050

COMMONWEALTH OF AUSTRALIA.

Postmaster-General's Department,
16*th May*, 1911.

TENDERS are invited up to 23rd AUGUST, 1911, for the supply of Letter Box Fronts, to the Postmaster-General's Department in Queensland.

Tender Forms and Specifications may be obtained at the Commonwealth Office, London.

JOSIAH THOMAS,
Postmaster-General. 4129

COMMONWEALTH OF AUSTRALIA.

Postmaster-General's Department,
16*th May*, 1911.

TENDERS are invited up to 15th AUGUST, 1911, for the Supply of (*a*) 80,000 Insulators, and (*b*) India Rubber Covered Wire, to the Postmaster-General's Department in Victoria.

Tender Forms and Specifications may be obtained at the Commonwealth Office, London.

JOSIAH THOMAS,
Postmaster-General. 4130

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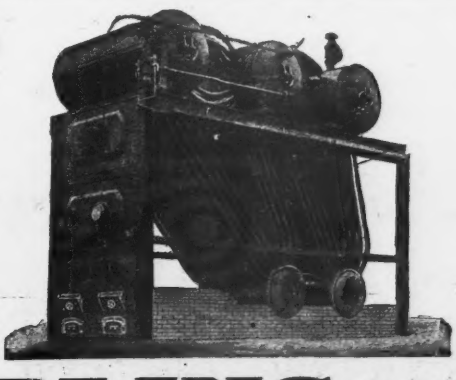

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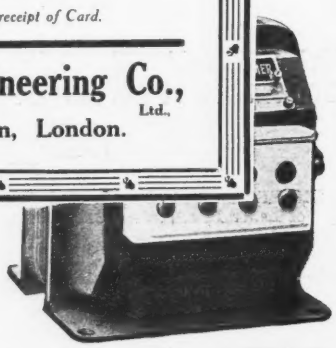

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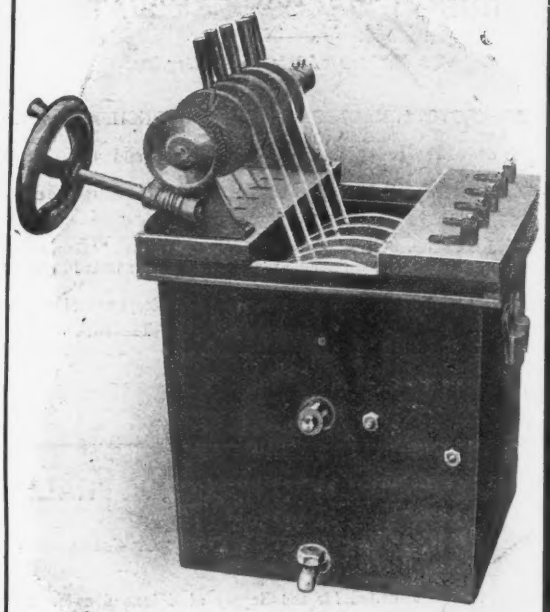

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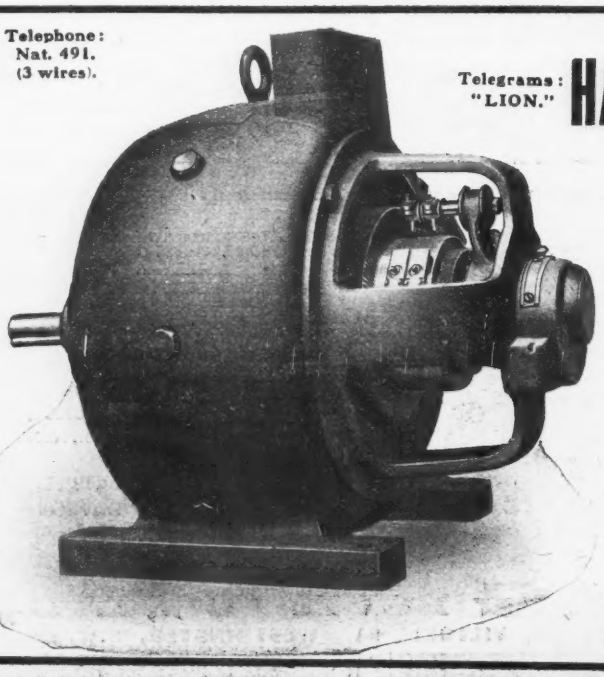

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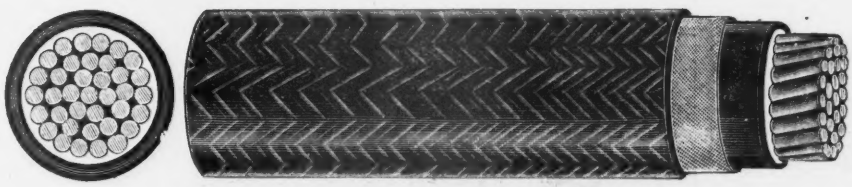

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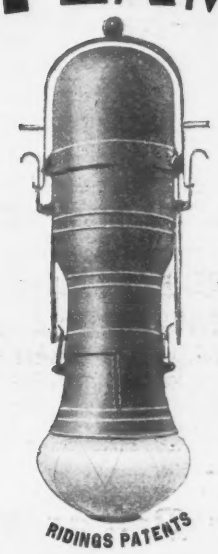

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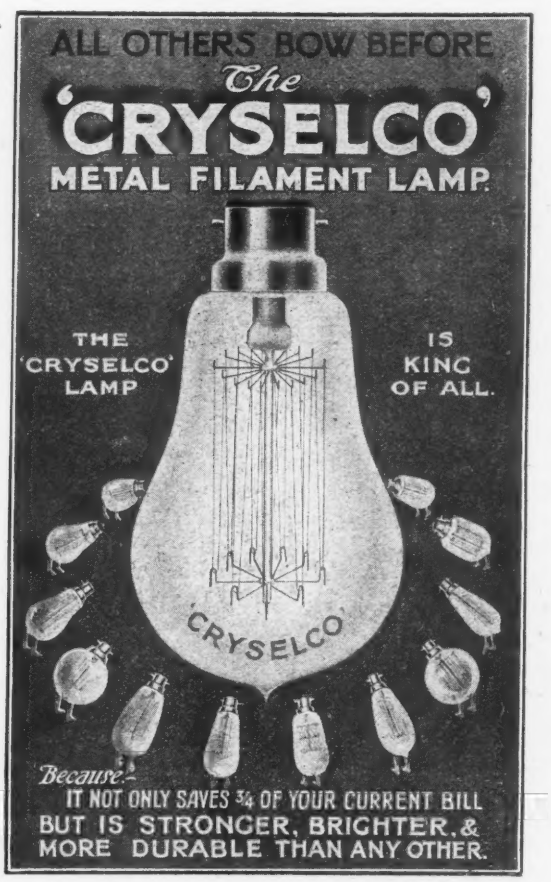

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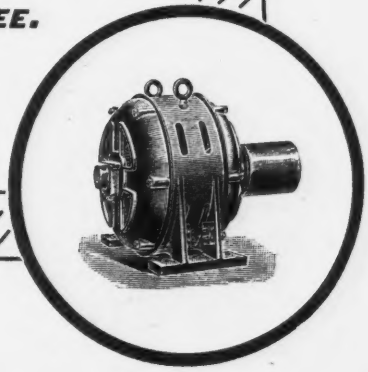

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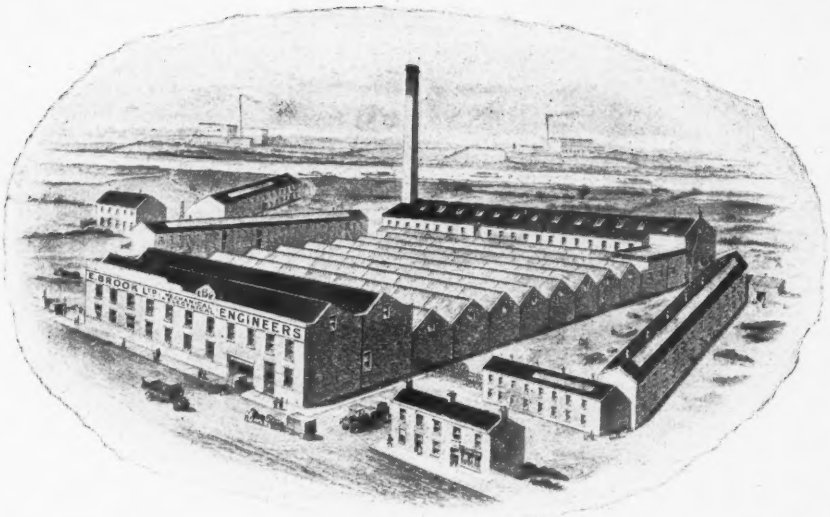

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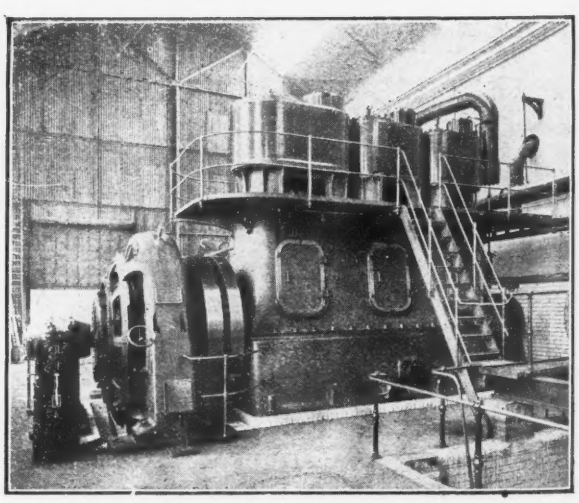

Illustration of 750 kw. Engine supplied to the Finchley Electricity Works.

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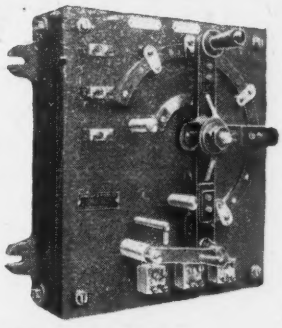

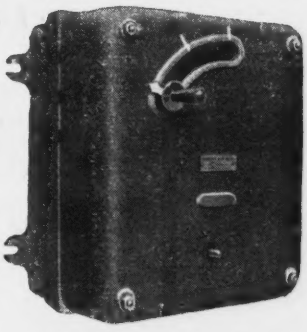

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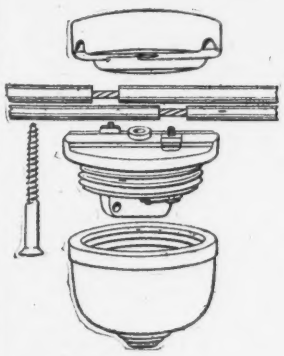

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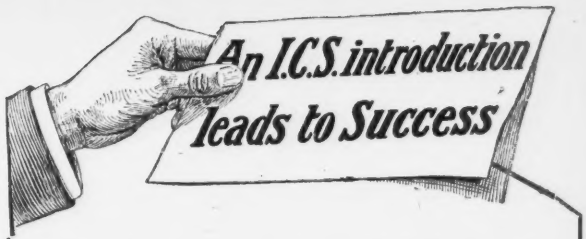

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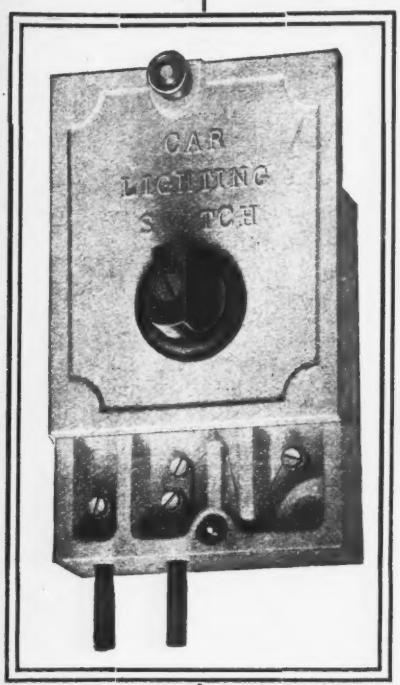

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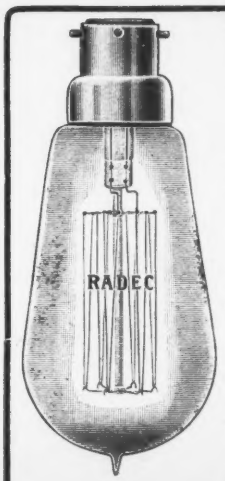

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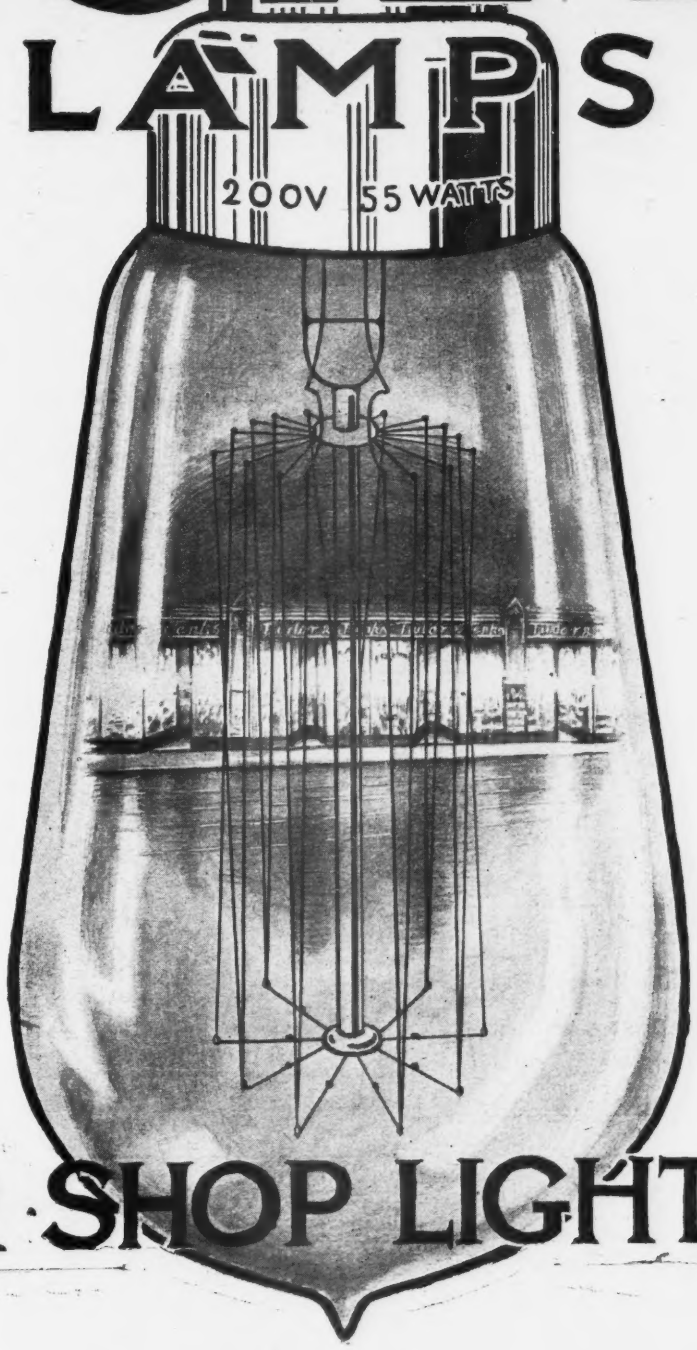

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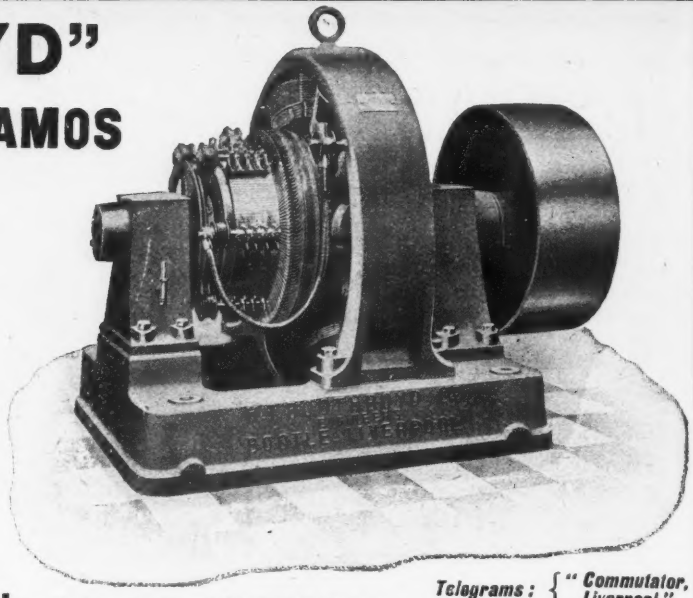

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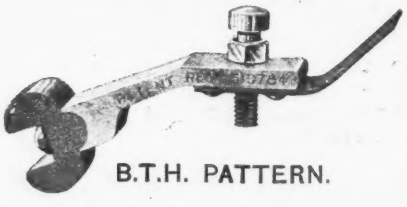

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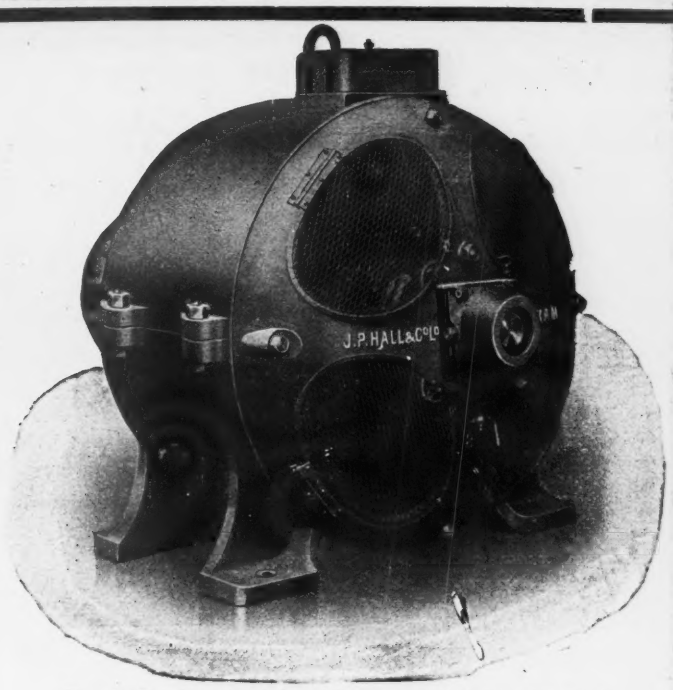

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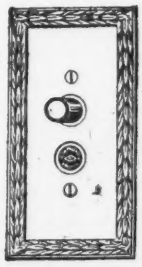

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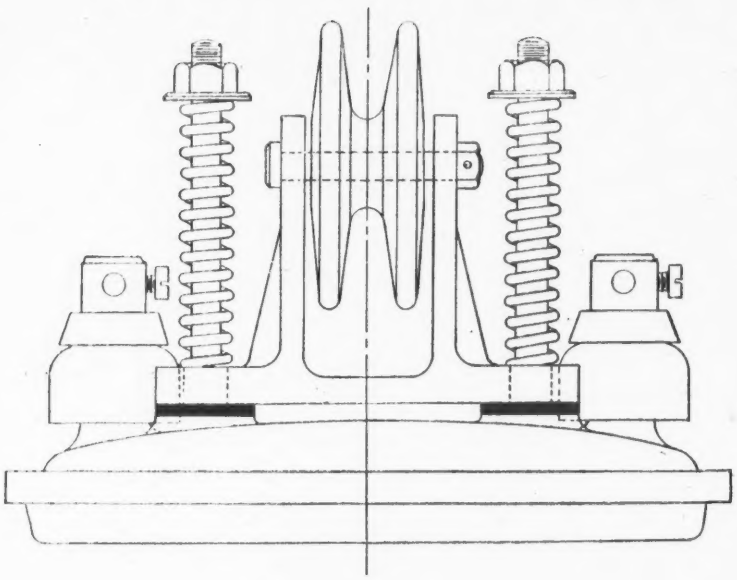

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"ELECTRICAL REVIEW" LIST OF ELE

OF

	Locality.	Lines owned	Year of opening.	Tramways Manager.	Tramways Electrical Engineer.	Miles of Route.	Gauge.	Weight of Rails per yard. lb.	Motor Cars.	Power Station. Total Capacity in KW.	Power Station. Max. load in KW.	Power Station. Battery max. discharge.	Capital Outlay on Tramways and Rolling Stock.	Capital Outlay on Power Station.	Annual Electric Car Mileage.	Passengers Carried per Annum.	
1	ABERDEEN	Aberdeen Corporation	1899	R. Stuart Pilcher (Gen. Man.)	J. Alex. Bell	14.4	4ft. 8½in.	98	44 d.d., 25 s.d.	4,610*	880	..	£327,546	*	1,585,137	17,156,050	*Ligh Co
2	ABERDEEN & DISTRICT	Aberdeen Suburban Tramways Co.	1904	A. Wilkie (Man. Dir.)	.. .. ..	5.5	4ft. 8½in.	95	7 d.d., 3 s.d.	*	..	..	£41,750	*	226,478†	2,217,975†	*Ene traffi
3	ACCRINGTON	Accrington Corporation	1907	James Wilson	Harold Gray	7.05	4ft. 0in.	95	18 d.d., 7 s.d.	*	..	..	£132,821	*	667,850	4,049,741	*Ligh Co
4	AIRDRIE AND COATBRIDGE	Airdrie & Coatbridge Tramways Co.	1904	A. Delves	.. .. ..	3.63	4ft. 7⅜in.	94	15 d.d.	*	..	..	£67,200	*	277,817	2,843,982	* Ene El
5	ASHTON, HYDE, DUKINF'D, STALYBRIDGE, MANCH'R.	Ashton-under-Lyne Corporation	1902	Ernest Holt (Gen. Man.)	N. Appelbee	9	4ft. 8½in.	96	9 d.d., 6 s.d., 6 comb.	1,760*	1,391	..	£107,751	£93,345	436,000	5,400,000	*Ligh
6	AYR	Ayr Corporation	1901	W. Grant	W. Grant	6	4ft. 8½in.	90	19 d.d.	1,325*	750	100 KW.	£82,170	£96,000*	387,704	3,588,628	*Ligh Co
7	BARKING	Barking Urban District Council	1903	Henley L. Howard	Henley L. Howard	3.25*	4ft. 8½in.	80, 100 and 106	7 d.d.	850†	584	..	£56,000*	£23,000†	105,000	1,280,420	* ¾ m sta
8	BARNSLEY	Barnsley & District Electric Traction Co., Ltd.	1902	P. H. Marco	P. H. Marco	3.06	4ft. 8½in.	94	12 d.d., 1 s.d. regen.	*	..	..	£64,783	*	196,042	1,762,252	*Ene Dec
9	BARROW-IN-FURNESS	British Electric Traction Co., Ltd.	1904	W. F. Bladon	.. .. ..	5.37	4ft. 0in.	94	9 d.d., 5 s.d., 2 demi-cars	*	..	..	..	*	329,495	3,052,571	*Ener Fur
10	BARTON-UPON-IRWELL	Barton-upon-Irwell R.D.C. (South Lancashire Tram. Co., Lessees)	1907	.. .. ..	.. .. ..	1.5	4ft. 8½in.	90	.. .. ..	..	..	..	£13,000	..	*	*	*Rece Tra
11	BATH	Bath Electric Tramways, Ltd.	1904	W. E. Hardy (G. Man. & Eng.)	W. E. Hardy	14.75	4ft. 8½in.	95	34 d.d., 6 comb.	675	..	..	£347,711		956,128	6,241,875	Twelv
12	BATLEY	Yorkshire (Woollen District) Electric Tramways, Ltd.	1903	E. A. Paris (Man. Director)	.. .. ..	7	4ft. 8½in.	104	.. .. ..	*	..	..	..	*	†	†	*Lg. adj
13	BELFAST	Belfast Corporation	1905	A. Nance (Man.) A. A.Blackburn(Eng.)	Thos. W. Bloxam (City Elec. Eng.)	38.50	4ft. 8½in.	105	242 d.d. (158 covd.)	8,800*	6,915 (tr.& lg.)	..	£462,743†	£87,159*	5,129,698	49,485,091	*Lg. pur
14	BEXLEY	Bexley Urban District Council	1903	C. Mittelhausen	C. Mittelhausen	5.32	4ft. 8½in.	90	16 d.d.	480 (tr.)*	220	37 KW.	£74,254	£27,563†	295,130§	2,166,494	*Tran £5,
15	BIRKENHEAD	Birkenhead Corporation	1901	Wm. Wyld	Wm. Wyld	13.5	4ft. 8½in.	100	59 d.d.	1,475*	1,250	201.6 KW.	£309,510	£53,918*	1,207,761	12,544,501	*Ener to M
16	BIRMINGHAM	City of Birmingham Tramways Co.	1901	W. G. Bond (Gen. Man.)	.. .. ..	18*	3ft. 6in.	90 & 97	139 d.d. 10 s.d.(48 cable)	1,098†	..	..	£457,125 (inc. cable)		2,252,064	37,051,126 exc. cable.	*6⅔ m †Tw
17	BIRMINGHAM	Birmingham Corporation	1904	Alfred Baker	.. .. ..	84	3ft. 6in.	104	300 d.d.	*	..	..	£936,000	*	6,011,788	75,601,195	*Ener Ele
18	BIRMINGHAM	Birmingham & Midland Tramways Ltd.	1905	W. G. Bond (Gen. Man.)	.. .. ..	12.2	3ft. 6in.	..	50 d.d., 8 s.d.	6,500	..	..	£325,854	£156,308	1,028,223	11,081,098	Part Cor
19	BLACKBURN	Blackburn Corporation	1899	James H. Cowell (Eng. & Man.)	.. .. ..	14.67	4ft. 0in.	92¼	48 d.d., 12 s.d., 1 open car.	4,518*	1,650	550 KW.	£335,006	£280,000*	1,106,912	10,310,965	*Ligh Ele
20	BLACKPOOL	Blackpool Corporation	1885	C. Furness (Man.) F. Field (Eng.)	Charles Furness(G. Man. & Trys. Eng.)	11.87	4ft. 8½in.	95	65 d.d.	1,500*	1,210*	1,680 A.H.	£283,181	£300,000*	952,127	8,998,565	*Ligh Ele
21	BLACKPOOL & FLEETWOO	Blackpool & Fleetwood Tramroad Company	1898	J. Cameron	Angus Cameron	8	4ft. 8½in.	98, 83 and 70	37 s.d.	600	480	380 KW.	£198,479		592,312	2,939,144	Data
22	BLACKPOOL, ST. ANNES & LYTHAM	Blackpool, St. Annes & Lytham Tramways Co., Ltd.	1903	Harry W. Laing	Harry W. Laing	7.5	4ft. 8½in.	90	40 d.d.	760*	510	..	..	..	632,000	3,313,500	*Ligh
23	BOLTON	Bolton Corporation	1900	Arthur A. Day	Arthur A. Day	26	4ft. 8½in.	96	103 d.d., 3 s.d.	7,600*	2,000	..	£538,214	£382,456*	2,757,066	27,637,112	*Ligh Ele
24	BOOTLE	Bootle Corporation	1900	T. Dawson Clothier	T. Dawson Clothier	3.87	4ft. 8½in.	90	*	2,050†	400 (tr. only)	150 KW.	£75,616	£17,227†	*	*	*Runi and
25	BOURNEMOUTH, POOLE & CHRISTCHURCH	Bournemouth Corporation	1902	C. W. Hill (Gen. Man.)	I. Bulfin	21.5	3ft. 6in.	90, 100, 105	80 d.d., 1 saloon	1,200	1,000	..	£390,224		1,782,706	14,090,000	1.35 m Chr
26	BRADFORD	Bradford Corporation	1898	C. J. Spencer (G. Man. & Eng.)	C. J. Spencer	54.81	4ft. 0in.	102	238 d.d.	*	..	..	£944,928	*	5,461,562	52,919,559	*Lg. & and
27	BRIGHTON	Brighton Corporation	1901	W. Marsh	W. Marsh	9.49	3ft. 6in.	105	50 d.d.	10,700	1,270	550 KW.	£274,905	*	1,126,676	10,708,184	*Ligh Ele
28	BRIGHTON BEACH	Volk's Electric Railway (Magnus Volk, Ltd.)	1883*	M. H. Volk	M. H. Volk	1.5	2ft. 8½in.	35	8 s.d.	60†	40†	36 KW.	£10,000		80,000	700,000	*Pion from
29	BRISTOL	Bristol Tramways & Carriage Co., Ltd.	1895 (elec.)	Chas. Challenger	.. .. ..	30.5	4ft. 8½in.	92½	234 d.d.	2,150	..	..	£1,491,453	..	5,727,943 (1907)	46,652,389	Data f
30	BURNLEY	Burnley Corporation	1902	H. Mozley	James E. Starkie	11.90	4ft. 0in.	102 & 105	43 d.d., 9 s.d. (11 covered)	2,640*	1,772*	560 A.H. (2 hrs.)	£246,125 inclusive	£112,242*	1,306,860	13,107,836	*Light Burn
31	BURTON-ON-TRENT	Burton-on-Trent Corporation	1903	A. B. Slater	Thos. Hall	6.66*	3ft. 6in.	90	20 d.d.	1,710†	375 (tr. only)	..	£106,012	£84,358	432,911	3,131,172	*1 mi and
32	BURTON SWADLINCOTE, ASHBY AND CRESLEY	Midland Railway Co.	1906	James Toulmin	James Toulmin	12.02	3ft. 6in.	90	20 d.d.	330	..	440 A.	..	..	..	..	Data t
33	BURY (LANCS.)	Bury Corporation	1903	William Clough	S. J. Watson (Boro' Elec. Eng.)	22.5	4ft. 8½in.	102⅔	50 d.d.	1,500*	825	..	£282,893	*	1,573,686	13,236,628	*Light
34	CAMBORNE, REDRUTH AND ILLOGAN	Urban Electric Supply Co., Ltd. Camborne & Redruth Tramways	1902	L. A. Hards	L. A. Hards	3.4	3ft. 6in.	85	6 d.d., 2 s.d.	1,025†	988	150 KW.	£45,902	£65,716†	156,170	1,309,185	*2 elec †Lg.
35	CAMBUSLANG, HAMILTON MOTHERWELL & WISHAW	Lanarkshire Tramways Co.	1903	G. F. Moller	G. F. Moller	17	4ft. 7⅜in.	96 & 101	60 d.d.	825	945	..	£314,621†	£57,575	1,744,198	13,169,448	*Also †Ex.
36	CARDIFF	Cardiff Corporation	1902	Arthur Ellis	Arthur Ellis	17.35	4ft. 8½in.	100	100 d.d., 14 s.d., 16 comb.	7,000*	3,600*	150 KW.	£778,017 inclusive	..	2,475,542	25,662,830	Energy *Incl
37	CARLISLE	City of Carlisle Electric Tramways Co., Ltd.	1900	..	..	7	3ft. 6in.	87	12 d.d., 3 s.d.	*	..	..	£101,183	*	342,826	2,485,321	*Energ Dec.
38	CAVEHILL AND WHITEWELL	Cavehill & Whitewell Tramway Co.	1906	F. P. Comber	.. .. ..	3.29	4ft. 9in.	105	8 d.d.	*	..	..	£67,211	*	125,354	524,775	*Energ
39	CHATHAM, GILLINGHAM, RAINHAM, ROCHESTER	Chatham District Light Railways Co.	1902	W. Jensen	J. C. Whiteley	14.98	3ft. 6in.	95 to 105	45 d.d.	675†	712	..	£188,600	£63,000 inc. car shed	1,143,120	9,217,087	*Also S energy
40	CHELTENHAM & DISTRICT	Cheltenham and District Light Railway Co.	1901	H. J. McCormick	.. .. ..	10.13	3ft. 6in.	83 & 90	18 d.d., 2 s.d.	*	..	..	£120,000	*	514,383	2,676,238	*Energ light
41	CHESTER	Chester Corporation	1903	J. Gardner	S. E. Britton	3.62	3ft. 6in.	92 & 100	17 d.d., 1 s.d. (inc. regen.)	1,325*	1,400	154 KW.	£82,848	£122,379	349,820	3,114,920	*Lighti
42	CHESTERFIELD	Chesterfield Corporation	1904	R. L. Acland	R. L. Acland	3.62	4ft. 8½in.	96	14 d.d.	1,000*	300	..	£69,792	£7,000†	282,228	2,450,000	*Lighti tracti
43	CLONTARF AND HOWTH	Clontarf & Hill of Howth Tramroad Co.*	1900	..	..	5.5	5ft. 3in.	60, 83, 95	12 d.d.	*	..	..	£72,500	*	*	*	*Lease
44	COLCHESTER	Colchester Corporation	1904	R. C. Bullough	William Frisby	6	3ft. 6in.	95	18 d.d.	1,910	1,050	..	£69,555	£86,430*	322,612	1,738,172	*Lighti Corp
45	COLNE AND TRAWDEN	Colne and Trawden Light Railways Co.	1903	Marten Turner	Marten Turner	5.19	4ft. 0in.	103	12 d.d.	*	*	..	..	*	304,560	2,140,460	*Energ Dec.
46	CORK	Cork Electric Tramways & Lighting Co., Ltd.	1898	H. G. Whiting	H. H. Nalder	9.89	2ft. 11½in.	83	35 d.d.	2,680*	400 (tr. only)	..	£173,466	*	864,228	5,349,041	*Lighti
47	COVENTRY	Coventry Electric Tramways Co.	1895,'98, & 1905	T. R. Whitehead	I. E. Winslow (Cons. Eng.)	13.25	3ft. 6in.	81 & 65	40 d.d.	700	..	..	£200,631		885,929	5,957,564	65-lb. r Data
48	CROYDON	Croydon Corporation	1901	T. B. Goodyer	H. B. Harris	13	4ft. 8½in.	95 & 102	70 d.d.	1,750* (tr. only)	650	..	£257,176	*	2,269,000	19,476,576	*Lighti from
49	DARLINGTON	Darlington Corporation	1904	J. R. P. Lunn	J. R. P. Lunn	4.87	3ft. 6in.	90	16 s.d.	*	331.5	..	£76,269	*	377,144	3,315,374	*Lighti Corp.
50	DARTFORD, STONE AND CRAYFORD	Balfour, Beatty & Co., Lessees	1906	A. G. Balfour	A. G. Balfour	6.5	4ft. 8½in.	100	12 d.d.	*	..	..	..	*	317,127	2,055,033	*Energy Mar.
51	DARWEN	Darwen Corporation	1900	R.W. Smith-Saville (Gen. Man. & Eng.)	R. W. S.-Saville C. Garnett	4.25	4ft. 0in.	95½	14 d.d., 3 s.d. regen.	900*	300	92 KW.	£85,500	*	234,000	2,388,000	*Lighti
52	DERBY	Derby Corporation	1904	F. Harding	T. P. Wilmshurst	13	4ft. 0in.	95	45 d.d., 4 s.d.	1,100*	500	170 KW.	£236,018	£30,000* (tr. only)	1,156,246	9,909,359	*Lighti Electr
53	DEVONPORT AND DISTRICT	Devonport & District Tramways Co.	1901	C. W. Durnford	C. W. Durnford	8.85	3ft. 6in.	92	25 d.d.	*	..	..	£162,388	*	466,440	4,466,883	4½ mile from
54	DONCASTER	Doncaster Corporation	1902	E. S. Rayner	E. S. Rayner	8.3	4ft. 8½in.	100	25 d.d.	1,040*	475	..	£94,757	*	503,185	4,131,412	*Lighti per un
55	DOVER AND RIVER	Dover Corporation	1897	Edward Carden (G. M. & Elec. Eng.)	W. C. Hawke (Boro' Eng., P. W.)	4.75	3ft. 6in.	90 & 87	21 d.d.	209* (tr. only)	..	280 KW.-hours	£62,850	*	308,959	2,624,468	River I tractio
56	DUBLIN AND LUCAN	Dublin & Lucan Electric Railway Co.	1900	H. Harrison	H. Harrison	6.75	3ft. 6in.	50	6 d.d., 1 loco., 18 wagons	240	200	..	£68,504*	..	146,086	449,677	* Includi Dec. 3
57	DUBLIN AND SUBURBS	Dublin United Tramways Co. (1896) Ltd.	1896	R.S.Tresilian (Sec.) C.W.Gordon(Man.)	P. S. Sheardown	54.2	5ft. 3in.	105	327 d.d., 3 s.d.	4,600*	3,385	..	£2,054,294		7,741,385	54,356,330	*A.C. 2,5 Data t
58	DUDLEY, STOURBRIDGE AND DISTRICT	Dudley, Stourbridge and District Electric Traction Co., Ltd.	1899	W. G. Bond (Gen. Man.)	.. .. ..	20.82	3ft. 6in.	90	25 d.d., 27 s.d., 8 comb.	400	..	..	£330,379		1,046,351	6,750,703	Part pow Corpor
59	DUMBARTON AND DISTRICT	Dumbarton Burgh and County Tramways Co., Ltd.	1907	Joseph McMahon	Joseph McMahon	13	4ft. 7⅜in.	90	6 d.d., 24 comb.	*	741	..	..	*	402,489†	1,842,093†	*Energy Ltd. †
60	DUNDEE	Dundee Corporation	1900 (elec.)	Peter Fisher	H. Richardson	14½	4ft. 8½in.	94 to 100	60 d.d., 6 comb.	*	..	..	£380,038	*	1,281,552	16,367,911	*Lightin
61	DUNDEE AND DISTRICT	Dundee, Broughty Ferry & District Tramways Co., Ltd.	1905	Daniel Fisher	Daniel Fisher	5.22	4ft. 8½in.	90	14 d.d.	420	500	..	..	..	375,000	1,800,000	Data to J
62	DUNFERMLINE & DISTRICT	Dunfermline and District Tramways Co.	1909	James H. Shepherd	James H. Shepherd	11.5	3ft. 6in.	90	24 d.d.	*	*	..	£125,692	..	411,000	2,100,000	*Energy to Dec.
63	EAST HAM	East Ham Corporation	1901	W. C. Ullmann	W. C. Ullmann	7.6	4ft. 8½in.	90	45 d.d.	1,925*	1,500	..	£184,073	£126,958*	1,303,753	16,059,912	* Lightin Electri
64	ECCLES	Eccles Corporation, leased to and worked by Salford Corporation	1902	G. W. Holford (Tr. Man., Salford).	H. W. Angus (El. Eng., Eccles).	5.12	4ft. 8½in.	102	11 d.d.	240*	350	165 KW.†	£69,647	*	..	..	*Energy Highfie
65	ERITH	Erith Urban District Council	1905	Arthur Coveney	Arthur Coveney	4.70	4ft. 8½in.	100	14 d.d., 2 s.d. regen.	*	100 tr.	..	£80,655	£7,428†	335,312	2,622,903	*Energy plant in
66	EXETER	Exeter Corporation	1905	H C. Bartlett	H. D. Munro	4.25	3ft. 6in.	95	20 d.d.	*	..	..	£82,000	£9,000†	..	..	*Lightin
67	FALKIRK AND DISTRICT	Falkirk and District Tramways Co.	1905	D. Hays	D. Hays	6.21	4ft. 0in.	90	18 d.d.	*	..	..	£98,861	*	411,807	3,186,636	Extension *Energy p
68	FARNWORTH	Farnworth Urban District Council (leased to S. Lanc. Tramways Co.)	1901	E. H. Edwardes	A. J. Hutchinson	4.33	4ft. 8½in.	98	†	550*	300	..	£43,696 & £25,000	£42,000*	†	†	*Lightin Tramwa
69	FELIXSTOWE PIER	Coast Development Corporation	1905	H. Wood	E. A. Lambert	0.5	3ft. 6in.	36	2 motor, 1 trailer	*	..	..	..	*	..	..	Third-rail stowe Co
70	GATESHEAD, FELLING AND WHICKHAM	Gateshead & District Tramways Co.	1901	W. Morrison	.. .. ..	11.28	4ft. 8½in.	90	25 d.d., 15 s.d., 11 comb.	*	..	..	£318,385	*	1,272,957	11,970,002	*Energy Co., Ltd
71	GIANT'S CAUSEWAY & PORTRUSH	Giant's Causeway and Portrush Electric Tramway Co.	1883	D. Fall	W. A. Traill	8	3ft. 0in.	43 & 75	5 s.d., 18 tr.	110	90	..	£56,282	..	36,969	132,789	This was Kingdon
72	GLASGOW	Glasgow Corporation	1898	James Dalrymple	J. Ferguson (Chf.) E. T. Goslin (El.)	98.58	4ft. 7⅜in.	110	803 d.d.	14,200	9,103	..	£2,866,557	£636,617	21,704,237	237,967,307	6,500v. 3-p
73	GLOSSOP	Urban Electric Supply Co., Ltd.	1903	C. E. Knowles	C. E. Knowles	4.5	4ft. 8½in.	90	7 d.d., 1 s.d.	425*	150 (tr. only)	600 A.H.	£54,097	£49,247*	205,873	1,571,987	*Lighting
74	GLOUCESTER	Gloucester Corporation	1904	Leonard Johnston	Leonard Johnston	9	3ft. 6in.	90	30 d.d.	1,150*	400	..	£144,192 (net)	*	586,290	3,853,492	*Lighting Elec. De
75	GOSPORT & FAREHAM	Provincial Tramways Co., Ltd.	1906	J. Fereday Glenn	J. Fereday Glenn J. Glenn (Cons.)	7.48	4ft. 7⅜in.	95	22 d.d.	750*	..	..	..	..	470,851	2,098,714	*Bulk supp Co. Da
76	GRAVESEND, NORTHFLEET AND SWANSCOMBE	Gravesend and Northfleet Electric Tramways, Ltd.	1902	P. N. Gray	.. .. ..	6.5	4ft. 8½in.	87	16 d.d., 2 s.d.	*	..	..	£98,646	*	301,389	2,472,176	* Energy p to Dec.
77	GREENOCK AND PORT GLASGOW	Greenock & Port Glasgow Tramways Co.	1901	A. Robertson	.. .. ..	7.42	4ft. 7⅜in.	92	40 (1 demi-car)	*	..	..	£237,771	*	734,647	7,278,253	* Energy p
78	GRIMSBY & CLEETHORPES	Gt. Grimsby Street Tramways Co.	1902	H. L. White	H. Orme White	6	4ft. 8½in.	90	32 d.d.	300	..	..	..	..	..	..	Energy pu Grimsby
79	CUERNSEY ST. PETER PORT & ST. SAMPSON'S	Guernsey Railway Co., Ltd.	1892	A. G. Bird	A. G. Bird	3.5	4ft. 8½in.	40, 74 & 84	9 d.d., 1 s.d., 8 trailers	130	100	..	£27,632	..	Car 142,794 Tlrs.24,072	864,310	Refuse dest Data to
80	HALIFAX	Halifax Corporation	1898	W. M. Rogerson	W. M. Rogerson	37.4	3ft. 6in.	95.5	93 d.d., 2 s.d.	4,750*	2,960	660 KW.	£399,269	£259,313*	1,894,362	16,957,212	* Lighting 1½d. per u
81	HARTLEPOOL, EAST & WEST & SEATON CAREW	Hartlepool Electric Tramways Co., Ltd.	1896	George Cardwell	George Cardwell	6.72	3ft. 6in.	90	21 d.d.	400	360	..	£94,515		427,790	2,391,571	Data to Dec
82	HASLINGDEN	Haslingden Corporation	1908	Barnes Kay	Barnes Kay	3	4ft. 0in.	100	*	†	..	100 KW.	£25,000*	£1,387† (sub. stn.)	149,612	1,188,643	*Cars belon purchd. fr
83	HASTINGS, ST. LEONARDS AND BEXHILL	Hastings Tramways Co.	1905	Thos. B. Holliday	Thos. B. Holliday	19.3*	3ft. 6in.	90	65 d.d.	2,100	..	82 KW.	£488,300		1,402,000	8,652,210	Two rotary Dolter su
84	HERNE BAY PIER	Herne Bay U. D. C.	1898	Henry C. Dufton	Henry C. Dufton	0.75	3ft. 0in.	60	3 s.d.	50	..	..	..	..	..	..	Pier Electr deck. Ga
85	HEYWOOD	Heywood Corp. owner; Bury and Rochdale Corporations, lessees	1905	Jas. Stott	Jas. Stott	4.25	4ft. 8½in.	90	*	900†	300	..	£28,762	£6,496†	275,063	2,084,396	*Rolling sto Heywood.
86	HUDDERSFIELD	Huddersfield Corporation	1901	R. H. Wilkinson	R. H. Wilkinson	28.5	4ft. 7⅜in.	98 & 105	76 d.d.	2,200	1,870	..	£357,557	£50,769	2,058,663	19,001,660	Data to Mar
87	HULL	Hull Corporation	1899	W. J. McCombe	J. Wilkinson	16	4ft. 8½in.	94	136 d.d*	2,100	1,484	..	£481,933		3,695,281	37,948,671	*6 motor-bu
88	ILFORD	Ilford Urban District Council	1903	A. Woolstencroft (Traffic Sup.)	A. H. Shaw	6.62	4ft. 8½in.	100	26 d.d. (6 bogie cars)	*	..	..	£148,170	*	666,364	7,274,398	*Lighting ar
89	ILKESTON	Ilkeston Corporation	1903	H. P. Stokes	H. P. Stokes	3.8	3ft. 6in.	90	13 d.d.	1,000*	600	..	£47,745	*	254,035	1,765,454	* Energy pu Power Co.
90	IPSWICH	Ipswich Corporation	1903	F. Ayton	F. Ayton	10.8	3ft. 6in.	90	36 d.d.	*	..	..	£114,470	*	676,255	5,240,242	* Lighting s
91	ISLE OF MAN: (1) DOUGLAS-RAMSEY (2) SNAEFELL MOUNTAIN	Manx Electric Railway Co., Ltd.	1893, '94 1898 1895	F. Edmondson (Gen. Man.)	F. Edmondson	18 4.5	3ft. 0in. 3ft. 6in.	56 & 62½ 36	39 mr., 18 tr. (s.d. comb.) 2 automob.	1,300	1,337	347 KW.	..	..	360,083 (train miles)	533,104	Data to Sept
	(3) DOUGLAS SOUTHERN	Douglas Southern Electric Tramways, Ltd.	1896	R. Orton	R. Orton	3.5	4ft. 8½in.	65	8 d.d.	200	..	..	£41,445	..	36,385	196,088	Open in sum
92	ISLE OF THANET	Isle of Thanet Electric Tramways & Lighting Co., Ltd.	1901	J. A. Forde	J. A. Forde	11·5	3ft. 6in.	90	59 d.d.	1,500*	1,200 (inc. lg.)	60 KW.	..	*	720,360	4,531,506	* Lighting ar
93	JARROW AND DISTRICT	Jarrow & District Electric Traction Co., Ltd.	1906	W. Morrison (Man. Dir.)	G. McClelland (Supt.)	2.54	4ft. 8½in.	95	10 d.d.	*	..	..	£68,731	*	168,840	1,222,795	*Energy pur and South
94	KEIGHLEY	Keighley Corporation	1904	D. Gray	J. M. Smyth (Power Station)	3.27	4ft. 0in.	95	12 d.d., 2 motor buses	200*	160	..	£46,000	£42,000*	167,915 (9 months)	1,429,387 (9 months)	*Lighting ar ends Mar.
96	KIDDERMINSTER AND STOURPORT	Kidderminster & Stourport Electric Tramway Co.	1898	A. Charlton (Eng. & Man.)	A. Charlton	4.6	3ft. 6in.	75	4 d.d., 9 s.d.	*	..	..	£60,851	*	177,491	671,258	*Energy pur Lighting &

ELEC

	Name of Railway.	Districts Served.	Year of Opening.	Manager.	Electrical Engineer.	Consulting Engineers.	Length of Route in Miles.	Average distance between Stations, miles.	Average Schedule Speed, miles per hour.
1	CENTRAL LONDON RAILWAY	London: Shepherd's Bush (Wood Lane) to Bank. Extension to Liverpool St. under construction	1900	H. F. Parsball' (Chairman)	E.P. Grove (Chief Eng.)	Basil Mott	7 7.36 authorised	0.5	15
2	CITY & SOUTH LONDON ELECTRIC RAILWAY	London: Euston & King's Cross to City and Clapham Common	1890	T. C. Jenkin	P. V. McMahon	Basil Mott & David Hay	7.33	0.523	14.3
3	GREAT NORTHERN & CITY ELECTRIC RAILWAY	London: Finsbury Park to City	1904	R. P. Brousson	R. P. Brousson	Sir Douglas Fox & Partners	3.42	0.684	16.24

LECTRIC TRAMWAYS, RAILWAYS AND PO

OF THE UNITED KINGDOM.

gers ed m.	Remarks.	
050	*Lighting and traction station. Energy purchased from Corporation Electricity Dept. Data to May 31, 1910.	1
975†	*Energy purchased from Aberdeen Corp. †Including traffic over Aberdeen Corp's. lines. Data to Jan. 31, 1911	2
741	*Lighting and traction station. Energy purchased from Corporation Electricity Dept. Data to Mar. 31, 1911.	3
982	* Energy purchased from Coatbridge and Airdrie Electric Supply Co., Ltd. Data to Dec. 31, 1909	4
900	*Lighting and traction station. Data for 1909-10 ..	5
328	*Lighting and traction station. Energy purchased from Corporation. Data to May 15, 1910	6
220	* ¾ m. leased to East Ham. † Lighting and traction station	7
352	*Energy purchased from Barnsley Corporation. Data to Dec. 31, 1910	8
571	*Energy purchased from Corporation of Barrow-in-Furness. Data to Dec. 31, 1908	9
	*Receipts, passengers, &c., included in South Lancashire Tramway returns	10
575	Twelve motor omnibuses in use	11
	*Lg. & tr. stn. of the Batley Corp. †Run in conj. with adjoining lines of the Co. Data to Dec. 31, 1910	12
91	*Lg. & tr. stn.; capacity 8,800 KW. available for both purposes. †Track and cars only. Data to Mar. 31, 1911	13
94	*Tramway station supplying energy for lighting. †Lg. £5,137, tr. £22,426. §Bexley cars only. Data to Mar./10	14
01	*Energy purchased from Electricity Committee. Data to Mar. 31, 1911	15
26 ble.	*6¾ miles leased from Aston Corporation; 3 miles cable. †Two stations	16
95	*Energy purchased from Birmingham Corporation Electricity Department. Data to Mar. 31, 1908	17
98	Part power supplied by West Bromwich and Dudley Corporations. Data to Dec. 31, 1910	18
65	*Lighting and traction station. Energy purchased from Elec. Dept. at 1.4d. per unit. Data to Mar. 25, 1911	19
65	*Lighting and traction station. Energy purchased from Electricity Department. Data to Mar. 31, 1911	20
44	Data to Dec. 31, 1910	21
00	*Lighting and traction station. Data to Oct 31, 1910 ..	22
12	*Lighting and traction station. Energy purchased from Electricity Dept. Data to Mar. 31, 1911	23
	*Running leased to Liverpool Corporation. †Lighting and traction station. Data to Mar. 31, 1911	24
00	1.35 miles double-track conduit. Power for Poole and Christchurch supplied by Co. Data to Mar. 31, 1911	25
59	*Lg. & tr. stn, energy purchd. from Elec. Dept. at 1½d.p.u., and Shipley U.D.C. at 1⅜d. p.u. Data to Mar. 31, 1911	26
84	*Lighting and traction station; energy purchased from Electricity Department. Data to April 27, 1911	27
00	*Pioneer of electric traction in Great Britain. †Power from Brighton Corp. also. Data to Apr. 14, 1911	28
39	Data for 1908	29
36	*Lighting and traction station; energy purchased from Burnley and Nelson Corps. Data to Mar. 31, 1910	30
72	*1 mile leased to Midland Railway Co. † Lighting and traction station. Data to Mar. 31, 1911	31
	Data to April 28, 1911	32
38	*Lighting and traction station. Data to Mar. 31, 1910	33
5	*2 electric locos. & 16 wagons, 239 tons of tin ore daily. †Lg. & tr. stn.; 100 KW. for tr. Data to Dec. 31, 1910	34
8	*Also Bothwell, Uddingston, New Mains and Larkhall. †Ex. preliminary expenses, &c. Data to Dec. 31, 1909	35
0	Energy (5,519,044 units) sold to Lighting Dept. at cost. *Includes lighting load & plant. Data to Mar. 31, 1911	36
1	*Energy purchased from Carlisle Corporation. Data to Dec. 31, 1910	37
5	*Energy purchased from Belfast Corporation	38
7	*Also Strood, Frindsbury, Delce & Borstal, leased. †Part energy purch. from Kent El. P. Co. Data to Dec. 31, '10	39
8	*Energy purchased from Cheltenham Corporation lighting & traction station. Data to Aug. 16, 1910	40
0	*Lighting and traction station. Data to March 25, 1911	41
0	*Lighting and traction station. †Extra outlay for traction	42
	*Leased to Dublin United Tramways Co..	43
2	*Lighting and traction station. Energy purchased from Corporation at 1½d. per unit. Data to Mar. 31, 1911	44
0	*Energy purchased from Colne Corporation. Data to Dec. 31, 1910	45
1	*Lighting and traction station. Data to Dec. 31, 1909	46
4	65-lb. rails Falk welded, 81-lb. rails Thermit welded. Data to Dec. 31, 1910	47
3	*Lighting and traction station. Tramways taken over from Company, June, 1906. Data to Mar. 31, 1911	48
4	*Lighting and traction station. Energy purchased from Corp. Electricity Department. Data to Mar. 31, 1911	49
4	*Energy purchased from Dartford U. D. C. Data to Mar. 25, 1911	50
0	*Lighting and traction station. Data to Mar. 31, 1909..	51
	*Lighting and traction station. Energy purchased from Electricity Committee. Data to Mar. 31, 1910	52
	4½ miles leased from Corporation. *Energy purchased from Devonport Corporation. Data to Dec. 31, 1909	53
	*Lighting and traction station; energy supplied at 1½d. per unit. Data to Mar. 31, 1911	54
	River Light Rly. figures included. *Lighting and traction station. Data to Mar. 31, 1910	55
	* Including conversion & alteration of gauge. Data to Dec. 31, 1910	56
	*A.C. 2,500v. 3ph. to sub-stations, D.C. to line at 500v. Data to Dec. 31, 1910	57
	Part power supplied by Dudley Corp., also by Midland Corporation for E. P. D.	58
	*Energy purchased from Electric Supply Corporation, Ltd. †From Aug. 1, 1908, to Apr. 30, 1910	59
	*Lighting and traction station. Data to May 15, 1908 ..	60
	Data to July 31, 1910	61
	*Energy purchased from Fife Electric Power Co. Data to Dec. 31, 1910	62
	* Lighting and traction station; energy purchased from Electricity Department. Data to Mar. 31, 1910	63
	*Energy purchased from Eccles Corporation. †With Highfield booster	64
	*Energy purchd. from Electy. Dept. †Includes traction plant in pr. station, and cables. Data to Mar. 31, 1911	65
	*Lighting and traction station. †Tramways proportion	66
	Extensions to Grangemouth and Laurieston, 5.45 miles.	67
	*Energy purchased from Scottish Central Elec. Power Co. *Lighting and traction station. †Included in S. Lancs. Tramways Co.'s returns.	68
	Third-rail electric railway. *Energy supplied by Felixstowe Corporation	69
	*Energy purchased from County of Durham E. P. D. Co., Ltd. Data to Dec. 31, 1910	70
	This was the first electric tramway in the United Kingdom. Data to Jan. 1, 1911	71
	6,500v. 3-ph. to sub-stations. Data to May 31, 1911	72
	*Lighting and traction station. Data to end of 1909	73
	*Lighting and traction station. Energy purchased from Elec. Dept. at 1d. per unit. Data to Mar. 31, 1911	74
	*Lighting and traction station. Data to end of 1909	73
	*Lighting and traction station. Energy purchased from Elec. Dept. at 1d. per unit. Data to Mar. 31, 1911	74
	*Bulk supply to Gosport & Alverstoke Electric Lighting Co. Data to Sept. 30, 1910	75
	* Energy purchased from Gravesend Corporation. Data to Dec. 31, 1910	76
	* Energy purchased from Greenock Corporation ..	77
	Energy purchased from Grimsby Corpn. for lines in Grimsby	78
	Refuse destructor takes entire load when refuse available. Data to Dec. 31, 1910	79
	* Lighting and traction station; tramways supplied at 1½d. per unit. Data to Mar. 31, 1911	80
	Data to Dec., 1910	81
	*Cars belong Accrington & Rawtenstall Corpn. †Energy purchd. from Accrington Corpn. Data to Mar. 31, 1911	82
	Two rotary-converter sub-stations. *2 route miles on Dolter surface-contact system. Data to Dec. 31, 1910	83
	Pier Electric Railway. Third rail, angle bar beneath deck. Gas power. Data to April 28, 1911	84
	*Rolling stock supplied by Bury & Rochdale; energy by Heywood. †Lg. and tr. station. Data to Mar. 31, 1911	85
	Data to March 31, 1911	86
	*2 motor-buses. Data to March 31, 1911	87
	*Lighting and traction station. Data to Mar. 31, 1910	88
	* Energy purchased from Derbyshire and Notts. Electric Power Co. Data to March 31, 1911	89
	* Lighting and traction station. Data to Mar. 31, 1911	90
	Data to Sept. 30, 1910	91
	Open in summer only. Data to October 31, 1910 ..	
	* Lighting and traction station. Data to Sept. 30, 1910	92
	*Energy purchased from County of Durham E.P.D. Co. and South Shields Corp. Data to Dec. 31, 1910	93
	*Lighting and traction; 200 KW. for traction. Year ends Mar. 31, 1909	94
	Energy purchased from Kidderminster & Dist. Elec. Lighting & Traction Co., Ltd.	95

Locality.	Lines Owned by	Year of opening.	Tramways Manager.	Tramways Electrical Engineer.	Miles of Route.	Gauge.	Weight of Rails per yard, lb.	Motor Cars.	Power Station. Total Capacity in KW.	Power Station. Max. load in KW.	Power Station. Battery max. discharge.
96 KILMARNOCK	Kilmarnock Corporation	1904	Alf. H. Burbidge	Alf. H. Burbidge	4.29	4ft. 8½in.	90	14 d.d. ..	755*	199	..
97 KIRKCALDY	Kirkcaldy Corporation	1903	O. F. Francis ..	O. F. Francis ..	6.14	3ft. 6in.	87	22 d.d. ..	1,090*	385	200 KW.
98 LANCASTER	Lancaster Corporation	1903	Geo. C. Milnes..	Geo. C. Milnes..	4	4ft. 8½in.	90	12 d.d. ..	1,250*	700	..
99 LEAMINGTON & WARWICK	Leamington and Warwick Electrical Co., Ltd.	1905	R. L. McCulloch (Eng. & Man.)	R. L. McCulloch	3.05	3ft. 6in.	..	12 d.d. ..	630	..	..
100 LEEDS	Leeds Corporation	1897	J. B. Hamilton	J. Burbridge ..	57.5	4ft. 8½in.	100 & 105	281 d.d., 1 s.d.	5,900	4,961	..
101 LEICESTER	Leicester Corporation	1904	A. F. Lucas ..	T. R. Smith .. (Tram. Eng.)	20	4ft. 8½in.	100	140 d.d., 3 water	2,500	1,600	450 KW.
102 LEITH	Leith Corporation	1905	F. A. Fitzpayne (Gen. Manager).	A. Peden Rutherford (Bor. El. Eng.)	9	4ft. 8½in.	106.7	37 d.d. ..	2,232*	320	..
103 LEYTON	Leyton Urban District Council ..	1906	F. Schofield ..	F. Harman Lewis	9.5	4ft. 8½in.	105	60 d.d. ..	2,700*	1,759	450 KW.
104 LINCOLN AND BRACEBRIDGE	Lincoln Corporation	1905	Stanley Clegg ..	Stanley Clegg ..	1.75	4ft. 8½in.	100	8 d.d. ..	290* (tr.only)	185 (tr. only)	..
105 LIVERPOOL	Liverpool Corporation	1898	C. W. Mallins ..	A. B. Holmes (Cons.) A. Clough (Res.)	62.5	4ft. 8½in.	95, 110 & 123	537 d.d., 12 s.d.	37,000*	18,071	..
106 LIVERPOOL—PRESCOT ..	Lancashire Light Railway Co., Ltd.	1902	E. H. Edwardes	E. H. Edwardes	3	4ft. 8½in.	90	7 d.d. ..	*	..	..
107 LLANDUDNO, RHOS-ON-SEA & COLWYN BAY	Llandudno and Colwyn Bay Electric Railway, Limited	1907	J. W. McInnes..	.. .. ..	6.60	3ft. 6in.	90	18 s.d. ..	*	..	..
108 LONDON (COUNTY).. ..	London County Council	1903	A. L. C. Fell ..	.. .. ..	85.83	4ft. 8½in.	102 & 105	1120 d.d., 50 s.d.	24,000	17,000	..
109 LOWESTOFT	Lowestoft Corporation	1903	G. A. Bruce ..	G. A. Bruce ..	4	3ft. 6in.	100	15 d.d., 4 s.d.	*	..	..
110 LUTON	Balfour, Beatty & Co., Ltd., Lessees	1908	J. W. McInnes ..	W. H. Cooke (Boro' El. Eng.)	5.25	4ft. 8½in.	95	12 d.d. ..	1,150*	..	..
111 MAIDSTONE	Maidstone Corporation	1904	A. T. Lambert ..	A. T. Lambert ..	5.25	3ft. 6in.	96	17 d.d., 1 s.d., 1 w.tr.†	300*	280	150 KW.
112 MANCHESTER	Manchester Corporation	1901	J. M. McElroy..	J. J. McMahon..	105	4ft. 8½in.	105	555 d.d., 45 comb.	*	..	..
113 MANSFIELD & DISTRICT ..	Mansfield & Dist. Lt. Ry. Co. (controlled by M. & Dist. Tys. Ltd.)	1905	C. R. Walker ..	C. R. Walker ..	12.25	4ft. 8½in.	90	22 d.d. ..	*	..	..
114 MERTHYR TYDFIL	Merthyr Electric Traction and Lighting Co., Ltd.	1901	L. W. Dixon (Man. & Eng.)	T. H. Johnson (El. Eng.)*	3.04	3ft. 6in.	75	4 d.d., 12 s.d.	820	401 (tr. only)	300 KW.
115 MEXBOROUGH, RAWMARSH & SWINTON	Mexborough & Swinton Tramways Co.	1907	Percy Priestly ..	Percy Priestly ..	7	4ft. 8½in.	90	20 d.d. ..	450	..	..
116 MIDDLESBROUGH, STOCKTON & THORNABY	Imperial Tramways Co.	1898	..	.. .. ..	9	3ft. 6in.	92.5	50 d.d., 10 comb.	900	..	..
117 MIDDLESEX & HERTFORDSHIRE	Metropolitan Electric Tramways, Ltd.	1904	J. Devonshire .. (Man. Dir.)	A. H. Pott ..	55.4	4ft. 8½in.	101	276 d.d., 16 s.d.	*	..	..
118 MIDDLETON, ROCHDALE AND OLDHAM	Middleton Electric Traction Co., Ltd.	1902	W. F. Endean ..	.. .. ..	8.5	4ft. 8½in.	90	5 d.d., 18 s.d., 4 comb.	*	..	..
119 MUSSELBURGH & DISTRICT	Musselburgh and District Electric Light and Traction Co., Ltd.	1904	A. A. Watkins	A. A. Watkins ..	6.5	4ft. 8½in.	90	16 d.d. ..	600*	400	..
120 NELSON	Nelson Corporation	1903	D. Helme ..	D. Helme ..	2.75	4ft. 0in.	107	6 d.d., 3 s.d. comb.	1,000*	..	..
121 NEWCASTLE-ON-TYNE ..	Newcastle-on-Tyne Corporation..	1901	Ernest Hatton ..	Ernest Hatton ..	31.3	4ft. 8½in.	101	126 d.d., 60 s.d.	5,150	3,300	1,200 KW.
122 NEWPORT (MON.)	Newport Corporation	1903	H. Collings Bishop	H. Collings Bishop	7.5	4ft. 8½in.	96	43 d.d. ..	3,600*	2,350	750 KW.
123 NORTHAMPTON	Northampton Corporation ..	1904	J. Gottschalk ..	John F. Cameron	5.5	3ft. 6in.	90	24 d.d. ..	520	350	150 KW.
124 NORWICH	Norwich Electric Tramways Co...	1900	F. W. Ketley ..	F. W. Ketley ..	14.62	3ft. 6in.	65.5 & 90	42 d.d. ..	800	500	..
125 NOTTINCHAM	Nottingham Corporation	1901	J. Aldworth ..	H. Talbot ..	19	4ft. 8½in.	107	135 d.d. ..	8,576*	..	100 KW.
126 OLDHAM	Oldham Corporation	1900	J. W. Dugdale ..	S. W. Newington	23	4ft. 8½in.	100	57 d.d., 23 s.d.	2,565*	1,485	..
127 OLDHAM, ASHTON & HYDE	Oldham, Ashton & Hyde Electric Tramway, Ltd.	1899	J. V. Kitchener (Man. Dir.)*	E. T. Todd ..	9.13	4ft. 8½in.	96	12 d.d., 34 s.d.	†	..	..
128 PAISLEY, JOHNSTON, RENFREW, BARRHEAD	Paisley District Tramways Co. ..	1904	Fred Coutts ..	Fred Coutts. H. F. Parshall (Cons.)	20	4ft. 7¾in.	90 & 95	56 d.d., 2 s.d.	*	500	..
129 PENCE, SUTTON, WALL'N., MITCHAM, TTC., W.CH'N.	South Metropolitan Electric Tramways and Lighting Co., Ltd.	1906	A. V. Mason (Gen. Man.)	A. V. Mason ..	13.09*	4ft. 8½in.	90	51 d.d. ..	600 (tr. only)	200 (tr. only)	..
130 PERTH	Perth Corporation	1905	John Lambert ..	John Lambert ..	5.8	3ft. 6in.	90	12 d.d. ..	1,175*	200	..
131 PETERBOROUGH	Peterborough Electric Traction Co., Ltd.	1903	J. R. Groves ..	..	5.31	3ft. 6in.	94	14 d.d. ..	*	..	..
132 PLYMOUTH	Plymouth Corporation	1899	C. R. Everson ..	E. G. Okell ..	4.1	3ft. 6in.	92	26	700*	..	1,140 KW. hrs.
133 PLYMOUTH, STONEHOUSE AND DEVONPORT	Plymouth, Stonehouse & Devonport Tramways Co.	1901	G. H. Moreton ..	John Glenn ..	1.5	3ft. 6in.	84	14 d.d. ..	*	..	..
134 PONTYPRIDD	Pontypridd Urban District Council	1905	J. E. Teasdel ..	J. E. Teasdel ..	5.35	3ft. 6in.	95	20 d.d., 6 s.d.	1,400*	490 (tr.)	495 KW.
135 PORTSMOUTH	Portsmouth Corporation	1901	W. R. Spaven ..	V. G. Lironi ..	15.75	4ft. 7¾in.	96 & 100	100 d.d. ..	2,075	974	..
136 POTTERIES	Potteries Electric Traction Co., Ltd	1899	W. Thom ..	F. J. Chapple ..	31.68	4ft. 6in.	87 & 110	110 s.d. ..	2,100	..	..
137 PRESTON	Preston Corporation	1904	Jos. F. Simpson	Jos. F. Simpson	10	4ft. 8½in.	95	30 d.d. ..	600	450	..
138 PURBROOK, COSHAM, W'VILLE AND HORNDEAN	Provincial Tramways Co., Ltd. ..	1903	J. Fereday Glenn	J. Fereday Glenn J. Glenn (Cons.)	6	4ft. 7¾in.	96	16 d.d. ..	200*	..	500 A.
139 RADCLIFFE	Bury Corporation	1905	W. Clough ..	H. Wilkinson ..	..	4ft. 8½in.	100	.. ..	490*	310 (tr. only)	
140 RAWTENSTALL & BACUP	Rawtenstall Corporation	1909	C. L. E. Stewart	C. L. E. Stewart	11.75	4ft. 0in.	100	16 d.d., 6 s.d., 16 regen.	830*	500	140 KW.
141 READING	Reading Corporation	1903	Walter Binns ..	Walter Binns ..	7.5	4ft. 0in.	96	36 d.d. ..	400	503	..
142 RHONDDA (URBAN DISTRICT)	Rhondda Tramways Co., Ltd. ..	1908	H. J. Nisbett ..	H. J. Nisbett ..	18.5	3ft. 6in.	96	50 d.d. (25 covd.)	1,320*	1,110	..
143 ROCHDALE, LITTLEBOROUGH & HEYWOOD	Rochdale Corporation	1902	J. S. D. Moffet	C. C. Atchison.. (Boro' El. Eng.)	19.58	4ft. 8½in.	103	34 d.d., 25 comb.	2,176*	517 (tr. only	..
144 ROTHERHAM	Rotherham Corporation	1903	Edward Cross ..	Edward Cross ..	10.21	4ft. 8½in.	88.5 & 105	35 d.d., 1 water	1,650*	660	..
145 ROTHESAY	Rothesay Tramways Co., Ltd. ..	1902	A. Robertson ..	H. H. Hill ..	4.87	3ft. 6in.	97	20	350	..	350 A.H.
146 ST. HELENS & DISTRICT..	St. Helens Cor. (leased to New St. Helens & Dist. Tramway Co., Ltd.)	1900	C. D. Stanley ..	E. M. Hollingsworth	20	4ft. 8½in.	92	44 d.d. ..	*	..	..
147 SALFORD	Salford Corporation	1901	G. W. Holford ..	N. J. Hawkins	41	4ft. 8½in.	103	190 d.d., 10 comb.	6,400*	..	1,200 A.H.
148 SCARBOROUCH	Scarborough Tramways Co. ..	1904	Walter E. Nicoll	Walter E. Nicoll	4.78	3ft. 6in.	90	22 d.d., inc. 7 regen.	*	..	..
149 SEAFORTH, WATERLOO & CROSBY	Liverpool Overhead Railway Co.	1900	E. J. Neachell ..	E. J. Neachell ..	2.5	4ft. 8½in.	92½	12 d.d., 2 s.d.	160* (substn.)	..	1,300 A.H.
150 SHEERNESS & QUEENBOROUCH	Sheerness and District Electric Power and Traction Co., Ltd.	1903	G. L. Kirk ..	G. L. Kirk ..	2.5	3ft. 6in.	94	8 d.d. ..	700*	346	..
151 SHEFFIELD	Sheffield Corporation	1899	A. R. Fearnley ..	H. E. Yerbury ..	40	4ft. 8½in.	110	211 d.d., 53 s.d., 16 st. cars, etc.	5,725	4,500	..
152 SHIPLEY	Shipley Urban District Council*	1902	C. J. Spencer ..	S. D. Schofield..	6	4ft. 0in.	98	*	1,170†	702 KW.	150 KW.
153 SMETHWICK	Birmingham and Midland Tramways, Ltd.	1904	W. G. Bond ..	R. Humphries (try S.A. Mahood (pr.).	12.10	3ft. 6in.	90 & 94	50 d.d., 6 s.d.	6,500*	3,000	14.5 KW.
154 SOUTHAMPTON	Southampton Corporation ..	1900	H. F. Street ..	H. F. Street ..	11	4ft. 8½in.	98	49 d.d. ..	1,360*	..	1,500 KW.
155 SOUTHEND-ON-SEA ..	Southend Corporation	1901	Robert Birkett..	Robert Birkett ..	7	3ft. 6in.	90	21 d.d. ..	*	540	..
156 SOUTH LANCASHIRE ..	South Lancashire Tramways Co.	1902	E. H. Edwardes	E. H. Edwardes	39	4ft. 8½in.	90	82 d.d., 1 s.d.	2,750	1,500	..
157 SOUTHPORT	Southport Corp. (part leased to Southport & Birkdale Tram. Co.)	1900	J. Lloyd.. ..	H. Bentham ..	Cor. 8.5 Co. 8.17	4ft. 8½in.	87, 90, & 101	17 d.d., 1 s.d. 8 comb.	2,350*	1,435	600 KW.
158 SOUTHPORT & BIRKDALE	Southport Tramways Co., Ltd. ..	1901	J. Lloyd.. ..	H. Bentham ..	8.17	4ft. 8½in.	87	20 d.d. (1 regen.) 1s.d. (demi-car)	*	..	..
159 SOUTHPORT PIER	Southport Pier Co., Ltd.	1905	W. H. Scott ..	.. .. ..	0.6	3ft. 6in.	..	3 s.d. ..	*	..	..
160 SOUTH SHIELDS	South Shields Corporation ..	1906	Pier & Tram. Man. Lionel E. Harvey	J. H. Cawthra ..	10.25	4ft. 8½in.	95	35 d.d. ..	1,100tr.	..	..
161 SOUTH STAFFORDSHIRE*	South Staffs. Tramways Lessee Co.	1902	W. G. Bond (Gen. Man.)	.. .. ..	18.30	3ft. 6in.	90 & 96	29 d.d. ..	†	..	..
162 STALYBRIDGE, HYDE, MOSSLEY, DUKINFIELD	Stalybridge, Hyde, Mossley and Dukinfield Tr. & Elec. Board	1904	Frank Schofield	R. Blackmore ..	21	4ft. 8½in.	99	40 d.d., 10 s.d. 10 comb.	7,500*	5,500	750 A.H.
163 STOCKPORT & DISTRICT	Stockport Corporation	1901	A. T. Eardley ..	R. Lomax ..	15.5	4ft. 8½in.	105 & 99	50 d.d. ..	1,800	900	..
164 SUNDERLAND	Sunderland Corporation	1900	A. R. Dayson ..	A. R. Dayson ..	20	4ft. 8½in.	96	58 d.d., 8 s.d., 4 comb.	*	..	..
165 SUNDERLAND DISTRICT ..	Sunderland District Electric Tramways, Ltd.	1905	G. Stratton ..	G. Stratton ..	14.5	4ft. 8½in.	90	33 d.d. ..	*	..	..
166 SUTTON AND HOWTH ..	Great Northern Ry. Co. (Ireland)	1901	H. Plews (Gen. Man. G.N.R.I.)	A. W. Whieldon	5.37	5ft. 3in.	72	10 d.d., 1 s.d.	475	470	150 KW.
167 SWANSEA	Swansea Improvements & Tramway Co.	1900	D. James ..	A. Johnston ..	12.43*	4ft. 8½in.	87 & 95	23 d.d., 30 s.d. 12 comb.	640	597	..
168 SWINDON	Swindon Corporation	1904	T. Medcalf ..	A. Dimmack ..	3.7	3ft. 6in.	105	12 d.d. ..	900	200 (tr. only	..
169 TAUNTON	Taunton Electric Traction Co. Ltd.	1901	C. W. Durnford	.. .. ..	1.66	3ft. 6in.	90	6 s.d. ..	*	..	..
170 TORQUAY	Torquay Tramways Co., Ltd. ..	1907	Harry Holliday	.. .. ..	8.41	3ft. 6in.	90	18 d.d. ..	*	..	..
171 TYNEMOUTH & DISTRICT	Tynemouth and District Electric Traction Co., Ltd.	1901	R. Simpson ..	.. .. ..	4.21	3ft. 6in.	90	21 d.d. ..	*	..	..
172 TYNESIDE	Tyneside Tramways & Tramroads Co.	1902	J. C. Little .. H. England ..	F. H. Briggs .. C. J. Jewell ..	11 24.69	4ft. 8½in.	95	24 d.d. ..	*	..	..
173 WAKEFIELD & DISTRICT	Wakefield & District Light Railway Co.	1904	(Sec. & Res. Man.)			4ft. 8½in.	96	67 d.d. ..	1,600	1,431	100 KW.
174 WALLASEY	Wallasey Corporation	1902	R. R. Greene ..	J. A. Crowther ..	8.72	4ft. 8½in.	98	50 d.d. ..	1,100*	835	440 KW.
175 WALSALL	Walsall Corporation	1904	R. L. Horsfield..	A. S. Barnard ..	13.5	3ft. 6in.	90 & 92	32 d.d. ..	1,730*	1,026	..
176 WALTHAMSTOW	Walthamstow Urban District Council	1905	Wm. Murray ..	G. R. Spurr ..	9	4ft. 8½in.	100	32 d.d. ..	*	..	..
177 WALTON-ON-THE-NAZE PIER	Coast Development Corporation, Ltd.	1898	T. Faiers ..	E. A. Lambert ..	0.5	3ft. 6in.	36	1 motor car, 2 trailers	..	..	..
178 WARRINGTON	Warrington Corporation	1902	J. Telfer ..	F. V. L. Mathias	6.5	4ft. 8½in.	90	21 d.d. ..	2,150*	1,301	800 A.H.
179 WEMYSS & DISTRICT ..	Wemyss and District Tramways Co., Ltd.	1906	Major W. T. J. Marshall	R. Richardson ..	7.5	3ft. 6in.	95 & 97	17 s.d. ..	600	300	..
180 WEST BROMWICH	South Staffordshire (Lessee Co.)	1902	W. G. Bond ..	W. A. Jackson..	7	3ft. 6in.	97½	30 d.d. ..	1,550*	742 (tr. only	150 KW.
181 WEST HAM	West Ham Corporation	1904	H. E. Blain ..	.. .. ..	15.5	4ft. 8½in.	100	118 d.d., 2 water cars	11,400*	..	..
182 WEST MIDDLESEX, THAMES VALLEY & WIMBLEDON	London United Tramways, Ltd.	1901	A. H. Stanley ..	.. .. ..	55.5	4ft. 8½in.	92½ & 100	340 d.d. ..	3,500	..	..
183 WESTON-SUPER-MARE ..	Weston-super-Mare and District Electric Supply Co., Ltd.	1902	G. Charlton ..	G. Charlton ..	2.92	4ft. 8½in.	90	8 d.d., 4 s.d.	1,100*	369	576 A.
184 WICAN	Wigan Corporation	1901	James Slevin ..	James Slevin ..	24.87	3ft. 6in. & 4ft. 8½in.	105	13 d.d., 54 s.d.	1,140*	..	750 A.H.
185 WOLVERHAMPTON	Wolverhampton Corporation ..	1902	W. A. Luntley .. (Gen. Man.)	C. Shawfield (Cons.) H. Vickers (El. Eng.)	13.5	3ft. 6in.	91 & 96	34 d.d., 4 s.d. 11 comb.	2,960* (tr. only)	1,300	750 A.H.
186 WOLVERHAMPTON DISTRICT	Wolverhampton District Electric Tramways, Ltd.	1900	W. G. Bond (Gen. Man.)	.. .. ..	14.70	3ft. 6in.	94	32 d.d. ..	*	..	..
187 WORCESTER	Worcester Electric Traction Co.	1904	J. R. Groves ..	.. .. ..	5.86	3ft. 6in.	94	15 d.d. ..	*	..	..
188 WREXHAM	Wrexham and District Electric Tramways, Ltd.	1903	A. A. Hawkins ..	.. .. ..	4.44	3ft. 6in.	97	10 d.d. ..	*	..	..
189 YARMOUTH	Yarmouth Corporation	1902	F. L. Turner ..	G. Bryant ..	10.5	3ft. 6in.	90	35 d.d. ..	400*	..	200 KW.-hours
190 YORK	York Corporation	1910	J. W. Hame ..	J. W. Hame ..	5.87	3ft. 6in.	100	22 d.d. ..	1,860	1,060	400 KW.
191 YORKSHIRE (WOOLLEN DISTRICT)*	Yorkshire (W. D.) Electric Tramways, Ltd.	1903	E. A. Paris .. (Man. Dir.)	.. .. ..	22.25	4ft. 8½in.	94	50 d.d., 16 s.d. 3 regen.	*	about 1,600	..

ECTRIC RAILWAYS.

Average Schedule Speed, miles per hour.	Weight of Rails per Yard. Running.	Weight of Rails per Yard. Conductor.	No. of Motor Cars.	No. of Trailers.	Power Station Capacity, Kilowatts.	Maximum Load Recorded, Kilowatts.	Maximum Output of Battery.	System of Generation.	Line Equipment.	Line Pressure.	Capital Outlaid.	Annual Train Mileage.	Passengers carried per Annum.	Ratio of Expenses to Receipts.	
15	100 lb.	85 lb.	64	172	7,600	..	..	5,000 v., 25~, 3-ph.	3rd rail	550 volts D.C.	.. ..	1,807,396 (1910)	40,660,856 (1910)	56.11% (1910)	Separate tunnels. Four rota day 1¾-minute)
14.3	60 lb. & 80 lb.	40 lb.	52 locos.	165 coaches

IEW" LIST OF ELECTRIC TRAMWAYS,

OF THE UNITED KINGDO

s of te.	Gauge.	Weight of Rails per yard. lb.	Motor Cars.	Power Station. Total Capacity in KW.	Power Station. Max. load in KW.	Power Station. Battery max. discharge.	Capital Outlay on Tramway and Rolling Stock.	Capital Outlay on Power Station.	Annual Electric Car Mileage.	Passengers Carried per Annum.	Remarks.	
.4	4ft. 8½in.	98	44 d.d., 25 s.d.	4,610*	880	..	£827,546	*	1,585,137	17,156,050	*Lighting and traction station. Energy purchased from Corporation Electricity Dept. Data to May 31, 1910.	1
.5	4ft. 8½in.	95	7 d.d., 3 s.d.	*	..	..	£41,750	*	226,478†	2,217,975†	*Energy purchased from Aberdeen Corp. †Including traffic over Aberdeen Corp's. lines. Data to Jan. 31, 1911	2
.05	4ft. 0in.	95	18 d.d., 7 s.d.	*	..	..	£132,821	*	667,850	4,049,741	*Lighting and traction station. Energy purchased from Corporation Electricity Dept. Data to Mar. 31, 1911.	3
.63	4ft. 7⅞in.	94	15 d.d. ..	*	..	..	£67,200	*	277,817	2,843,982	* Energy purchased from Coatbridge and Airdrie Electric Supply Co., Ltd. Data to Dec. 31, 1910	4
	4ft. 8½in.	96	9 d.d., 6 s.d., 6 comb.	1,760*	1,891	..	£107,751	£93,345	436,000	5,400,000	*Lighting and traction station. Data for 1909-10 ..	5
	4ft. 8½in.	90	19 d.d. ..	1,325*	750	100 KW.	£82,170	£96,000*	387,704	3,588,628	*Lighting and traction station. Energy purchased from Corporation. Data to May 15, 1910	6
.25*	4ft. 8½in.	80, 100 and 106	7 d.d. ..	850†	584	..	£56,000*	£23,000†	105,000	1,280,420	* ¾ m. leased to East Ham. † Lighting and traction station	7
.06	4ft. 8½in.	94	12 d.d., 1 s.d. regen.	*	..	..	£64,783	*	196,042	1,762,352	*Energy purchased from Barnsley Corporation. Data to Dec. 31, 1910	8
.37	4ft. 0in.	94	9 d.d., 5 s.d., 2 demi-cars	*	..	..	..	*	329,495	3,052,571	*Energy purchased from Corporation of Barrow-in-Furness. Data to Dec. 31, 1908	9
.5	4ft. 8½in.	90	.. .. ..	..	..	..	£13,000	..	*	*	*Receipts, passengers, &c., included in South Lancashire Tramway returns	10
.75	4ft. 8½in.	95	34 d.d., 6 comb.	675	..	..	£347,711		956,128	6,241,875	Twelve motor omnibuses in use	11
.7	4ft. 8½in.	104	.. .. ..	*	..	..	..	*	†	†	*Lg. & tr. stn. of the Batley Corp. †Run in conj. with adjoining lines of the Co. Data to Dec. 31, 1910	12
.50	4ft. 8½in.	105	242 d.d. (158 covd.)	8,800*	6,915 (tr. & lg.)	..	£462,748†	£87,159*	5,129,698	49,485,091	*Lg. & tr. stn.; capacity 8,800 KW. available for both purposes. †Track and cars only. Data to Mar. 31, 1911	13
.32	4ft. 8½in.	90	16 d.d. ..	480 (tr.)*	220	97 KW.	£74,254	£27,563†	295,130§	2,166,494	*Tramway station supplying energy for lighting. †Lg. £5,137, tr. £22,426. §Bexley cars only. Data to Mar./10	14
.5	4ft. 8½in.	100	59 d.d. ..	1,475*	1,250	201.6 KW.	£309,510	£53,918*	1,207,761	12,544,501	*Energy purchased from Electricity Committee. Data to Mar. 31, 1911	15
.8	3ft. 6in.	90 & 97	189 d.d. 10 s.d. (48 cable)	1,098†	..	..	£457,125 (inc. cable)		2,252,064	37,051,126	*6¾ miles leased from Aston Corporation; 3 miles cable. †Two stations	16
.4	3ft. 6in.	104	800 d.d. ..	*	..	..	£936,000	*	6,011,738	75,601,195	*Energy purchased from Birmingham Corporation Electricity Department. Data to Mar. 31, 1908	17
.2	3ft. 6in.	..	50 d.d., 8 s.d.	6,500	..	..	£325,854	£156,808	1,028,223	11,081,098	Part power supplied by West Bromwich and Dudley Corporations. Data to Dec. 31, 1910	18
.67	4ft. 0in.	92½	48 d.d., 12 s.d., 1 open car.	4,518*	1,650	550 KW.	£335,006	£280,000*	1,106,912	10,310,965	*Lighting and traction station. Energy purchased from Elec. Dept. at 1.4d. per unit. Data to Mar. 25, 1911	19
.87	4ft. 8½in.	95	65 d.d. ..	1,500*	1,210*	1,680 A.H.	£283,181	£200,000*	952,127	8,998,565	*Lighting and traction station. Energy purchased from Electricity Department. Data to Mar. 31, 1911	20
.8	4ft. 8½in.	98, 83 and 70	37 s.d. ..	600	480	380 KW.	£198,479		592,312	2,939,144	Data to Dec. 31, 1910	21
.5	4ft. 8½in.	90	40 d.d. ..	760*	510	..	..	..	632,000	3,313,500	*Lighting and traction station. Data to Oct 31, 1910 ..	22
.26	4ft. 8½in.	96	103 d.d., 3 s.d.	7,600*	2,000	..	£538,214	£382,456*	2,757,066	27,637,112	*Lighting and traction station. Energy purchased from Electricity Dept. Data to Mar. 31, 1911	23
.87	4ft. 8½in.	90	*	2,050†	400 (tr. only)	150 KW.	£75,616	£17,227†	*	*	*Running leased to Liverpool Corporation. †Lighting and traction station. Data to Mar. 31, 1911	24
.5	3ft. 6in.	90, 100, 105	80 d.d., 1 saloon	1,200	1,000	..	£390,224		1,782,706	14,090,000	1.35 miles double-track conduit. Power for Poole and Christchurch supplied by Co. Data to Mar. 31, 1911	25
.81	4ft. 0in.	102	238 d.d. ..	*	..	..	£944,928	*	5,461,562	52,919,559	*Lg. & tr. stn, energy purchd. from Elec. Dept. at 1¼d.p.u., and Shipley U.D.C. at 1¾d. p.u. Data to Mar. 31, 1911	26
.19	3ft. 6in.	105	50 d.d. ..	10,700	1,270	550 KW.	£274,905	*	1,126,676	10,708,184	*Lighting and traction station; energy purchased from Electricity Department. Data to April 27, 1911	27
.5	2ft. 8½in.	35	8 s.d. ..	60†	40†	36 KW.	£10,000		80,000	700,000	*Pioneer of electric traction in Great Britain. †Power from Brighton Corp. also. Data to Apr. 14, 1911	28
.5	4ft. 8½in.	92½	234 d.d. ..	2,150	..	..	£1,491,453	..	5,727,943 (1907)	46,652,389	Data for 1908	29
.90	4ft. 0in.	102 & 105	43 d.d., 9 s.d. (11 covered)	2,640*	1,772*	560 A.H. (2 hrs.)	£246,125 inclusive	£112,242*	1,306,860	13,107,836	*Lighting and traction station; energy purchased from Burnley and Nelson Corps. Data to Mar. 31, 1910	30
.06*	3ft. 6in.	90	20 d.d. ..	1,710†	375 (tr. only)	..	£106,012	£84,358	432,911	3,131,172	*1 mile leased to Midland Railway Co. † Lighting and traction station. Data to Mar. 31, 1911	31
.02	3ft. 6in.	90	20 d.d. ..	330	..	440 A.	..	..	..	..	Data to April 28, 1911	32
.5	4ft. 8½in.	102½	50 d.d. ..	1,500*	825	..	£282,893	*	1,573,686	13,236,628	*Lighting and traction station. Data to Mar. 31, 1910	33
.1	3ft. 6in.	85	6 d.d., 2 s.d.*	1,025†	988	150 KW.	£45,902	£65,716†	156,170	1,309,185	*2 electric locos. & 16 wagons, 239 tons of tin ore daily. †Lg. & tr. stn.; 100 KW. for tr. Data to Dec. 31, 1910	34
.7	4ft. 7½in.	96 & 101	60 d.d. ..	825	945	..	£314,621†	£57,575	1,744,198	13,169,448	*Also Bothwell, Uddingston, New Mains and Larkhall. †Ex. preliminary expenses, &c. Data to Dec. 31, 1909	35
.35	4ft. 8½in.	100	100 d.d., 14 s.d., 16 comb.	7,000*	3,600*	150 KW.	£778,017 inclusive	..	2,475,542	25,662,830	Energy (5,519,044 units) sold to Lighting Dept. at cost. *Includes lighting load & plant. Data to Mar. 31, 1911	36
.7	3ft. 6in.	87	12 d.d., 3 s.d.	*	..	..	£101,183	*	342,826	2,485,321	*Energy purchased from Carlisle Corporation. Data to Dec. 31, 1910	37
.29	4ft. 9in.	105	8 d.d. ..	*	..	..	£67,211	*	125,354	524,775	*Energy purchased from Belfast Corporation	38
.98	3ft. 6in.	95 to 105	45 d.d. ..	675†	712	..	£188,600	£63,000 inc. car shed	1,143,120	9,217,087	*Also Strood, Frindsbury, Delce & Borstal, leased. †Part energy purch. from Kent El. P. Co. Data to Dec. 31, '10	39
.13	3ft. 6in.	83 & 90	18 d.d., 2 s.d.	*	..	..	£120,000	*	514,383	2,676,238	*Energy purchased from Cheltenham Corporation lighting & traction station. Data to Aug. 16, 1910	40
.02	3ft. 6in.	92 & 100	17 d.d., 1 s.d. (inc. regen.)	1,325*	1,400	154 KW.	£82,848	£122,379	349,820	3,114,920	*Lighting and traction station. Data to March 25, 1911	41
.02	4ft. 8½in.	95	14 d.d. ..	1,000*	300	..	£69,792	£7,000†	282,228	2,450,000	*Lighting and traction station. †Extra outlay for traction	42
.5	5ft. 3in.	60, 83, 95	12 d.d. ..	*	..	..	£72,500	*	*	*	*Leased to Dublin United Tramways Co.	43
.6	3ft. 6in.	95	18 d.d. ..	1,910	1,050	..	£69,555	£86,430*	322,612	1,738,172	*Lighting and traction station. Energy purchased from Corporation at 1½d. per unit. Data to Mar. 31, 1911	44
.19	4ft. 0in.	103	12 d.d. ..	*	*	..	..	*	304,560	2,140,460	*Energy purchased from Colne Corporation. Data to Dec. 31, 1910	45
.89	2ft. 11½in.	83	35 d.d. ..	2,680*	400 (tr. only)	..	£173,466	*	864,228	5,349,041	*Lighting and traction station. Data to Dec. 31, 1909	46
.25	3ft. 6in.	81 & 65	40 d.d. ..	700	..	..	£200,631		885,929	5,957,564	65-lb. rails Falk welded, 81-lb. rails Thermit welded. Data to Dec. 31, 1910	47
.1	4ft. 8½in.	95 & 102	70 d.d. ..	1,750* (tr. only)	650	..	£257,176	*	2,269,000	19,476,576	*Lighting and traction station. Tramways taken over from Company, June, 1906. Data to Mar. 31, 1911	48
.87	3ft. 6in.	90	16 s.d. ..	*	331.5	..	£76,269	*	377,144	3,315,374	*Lighting and traction station. Energy purchased from Corp. Electricity Department. Data to Mar. 31, 1911	49
.5	4ft. 8½in.	100	12 d.d. ..	†	..	..	..	*	317,127	2,055,033	*Energy purchased from Dartford U. D. C. Data to Mar. 25, 1911	50
.25	4ft. 0in.	95½	14 d.d., 3 s.d. regen.	900*	300	92 KW.	£85,500	*	234,000	2,388,000	*Lighting and traction station. Data to Mar. 31, 1909 ..	51
.6	4ft. 0in.	95	45 d.d., 1 s.d.	1,100*	500	170 KW.	£236,018	£30,000* (tr. only)	1,156,246	9,909,359	*Lighting and traction station. Energy purchased from Electricity Committee. Data to Mar. 31, 1910	52
.85	3ft. 6in.	92	25 d.d. ..	*	..	..	£162,388	*	466,440	4,466,883	4½ miles leased from Corporation. * Energy purchased from Devonport Corporation. Data to Dec. 31, 1909	53
.3	4ft. 8½in.	100	25 d.d. ..	1,040*	475	..	£94,757	*	503,185	4,131,412	*Lighting and traction station; energy supplied at 1½d. per unit. Data to Mar. 31, 1911	54
.75	3ft. 6in.	90 & 87	21 d.d. ..	209* (tr. only)	..	280 KW.-hours	£62,850	*	308,959	2,624,468	River Light Rly. figures included. *Lighting and traction station. Data to Mar. 31, 1910	55
.75	3ft. 6in.	50	6 d.d., 1 loco., 18 wagons	240	200	..	£68,504*	..	146,086	449,677	* Including conversion & alteration of gauge. Data to Dec. 31, 1910	56
.4.2	5ft. 3in.	105	327 d.d., 3 s.d.	4,600*	3,385	..	£2,054,294		7,741,385	54,356,330	*A.C. 2,500v. 3ph. to sub-stations, D.C. to line at 500v. Data to Dec. 31, 1910	57
.82	3ft. 6in.	90	25 d.d., 27 s.d., 8 comb.	400	..	..	£330,879		1,046,351	6,750,703	Part power supplied by Dudley Corp., also by Midland Corporation for E. P. D.	58
.13	4ft. 7½in.	90	6 d.d., 24 comb.	*	741	..	..	*	402,489†	1,842,093†	*Energy purchased from Electric Supply Corporation, Ltd. †From Aug. 1, 1908, to Apr. 30, 1910	59
.4½	4ft. 8½in.	94 to 100	60 d.d., 6 comb.	*	..	..	£380,038	*	1,281,552	16,367,911	*Lighting and traction station. Data to May 15, 1908 ..	60
.22	4ft. 8½in.	90	14 d.d. ..	420	500	..	..	..	375,000	1,800,000	Data to July 31, 1910	61
.5	3ft. 6in.	90	24 d.d. ..	*	*	..	£125,692	..	411,000	2,100,000	*Energy purchased from Fife Electric Power Co. Data to Dec. 31, 1910	62
.6	4ft. 8½in.	90	45 d.d. ..	1,925*	1,500	..	£184,073	£120,958*	1,303,753	16,059,912	* Lighting and traction station; energy purchased from Electricity Department. Data to Mar. 31, 1910	63
.12	4ft. 8½in.	102	11 d.d. ..	240*	350	165 KW.†	£69,647	*	..	..	*Energy purchased from Eccles Corporation. †With Highfield booster	64
.70	4ft. 8½in.	100	14 d.d., 2 s.d. regen.	*	100 tr.	..	£80,655	£7,428†	335,312	2,622,903	*Energy purchd. from Electy. Dept. †Includes traction plant in pr. station, and cables. Data to Mar. 31, 1911	65
.25	3ft. 6in.	95	20 d.d. ..	*	..	..	£82,000	£9,000†	..	..	*Lighting and traction station. †Tramways proportion	66
.21	4ft. 0in.	90	18 d.d. ..	*	..	..	£98,861	*	411,807	3,186,636	Extensions to Grangemouth and Laurieston, 5.45 miles.	67
.33	4ft. 8½in.	98	†	550*	300	..	£43,696 & £25,000	£42,000*	†	†	*Energy purchased from Scottish Central Elec. Power Co. *Lighting and traction station. †Included in S. Lancs. Tramways Co.'s returns.	68
.5	3ft. 6in.	36	2 motor, 1 trailer	*	..	..	..	*	..	..	Third-rail electric railway. *Energy supplied by Felixstowe Corporation	69
.28	4ft. 8½in.	90	25 d.d., 15 s.d., 11 comb.	*	..	..	£318,385	*	1,272,957	11,970,002	*Energy purchased from County of Durham E. P. D. Co., Ltd. Data to Dec. 31, 1910	70
.8	3ft. 0in.	43 & 75	5 s.d., 18 tr.	110	90	..	£56,282	..	36,969	132,780	This was the first electric tramway in the United Kingdom. Data to Jan. 1, 1911	71
.58	4ft. 7½in.	110	803 d.d. ..	14,200	9,103	..	£2,866,557	£636,617	21,704,237	237,967,307	6,500v. 3-ph. to sub-stations. Data to May 31, 1911	72
.5	4ft. 8½in.	90	7 d.d., 1 s.d.	425*	150 (tr. only)	600 A.H.	£54,097	£49,247*	205,873	1,571,987	*Lighting and traction station. Data to end of 1909	73
.0	3ft. 6in.	90	30 d.d. ..	1,150*	400	..	£144,192 (net)	*	586,290	3,853,492	*Lighting and traction station. Energy purchased from Elec. Dept. at 1d. per unit. Data to Mar. 31, 1910	74
.48	4ft. 7½in.	95	22 d.d. ..	750*	..	..	..	..	470,851	2,098,714	*Bulk supply to Gosport & Alverstoke Electric Lighting Co. Data to Sept. 30, 1910	75
.5	4ft. 8½in.	87	16 d.d., 2 s.d.	*	..	..	£98,646	*	301,389	2,472,176	* Energy purchased from Gravesend Corporation. Data to Dec. 31, 1910	76
.12	4ft. 7½in.	92	40 (1 demi-car)	*	..	..	£237,771	*	734,647	7,278,253	* Energy purchased from Greenock Corporation ..	77
.6	4ft. 8½in.	90	32 d.d. ..	300	..	..	..	..	..	..	Energy purchased from Grimsby Corpn. for lines in Grimsby	78
.5	4ft. 8½in.	40, 74 & 84	9 d.d., 1 s.d., 8 trailers	130	100	..	£27,632	..	Car 142,794 Trs. 24,072	864,310	Refuse destructor takes entire load when refuse available. Data to Dec. 31, 1910	79
.7.4	3ft. 6in.	95.5	93 d.d., 2 s.d.	4,750*	2,960	660 KW.	£399,269	£259,313*	1,894,262	16,957,212	* Lighting and traction station; tramways supplied at 1¼d. per unit. Data to Mar. 31, 1911	80
.72	3ft. 6in.	90	21 d.d. ..	400	360	..	£94,515		427,790	2,391,571	Data to Dec., 1910	81
.1	4ft. 0in.	100	*	†	..	100 KW.	£25,000*	£1,387† (sub. stn.)	149,612	1,188,643	*Cars belong Accrington & Rawtenstall Corpn. †Energy purchd. from Accrington Corpn. Data to Mar. 31, 1911	82
.3	3ft. 6in.	90	65 d.d. ..	2,100	..	82 KW.	£488,300		1,402,000	8,652,210	Two rotary-converter sub-stations. *2 route miles on Dolter surface-contact system. Data to Dec. 31, 1910	83
.75	3ft. 0in.	60	3 s.d. ..	50	..	..	..	..	..	..	Pier Electric Railway. Third rail, angle bar beneath deck. Gas power. Data to April 28, 1911	84
.25	4ft. 8½in.	90	*	900†	300	..	£28,762	£6,496†	275,063	2,084,396	*Rolling stock supplied by Bury & Rochdale; energy by Heywood. †Lg. and tr. station. Data to Mar. 31, 1911	85
.8.5	4ft. 7½in.	98 & 105	76 d.d. ..	2,200	1,870	..	£357,557	£50,769	2,058,663	19,001,660	Data to March 31, 1911	86
.6	4ft. 8½in.	94	136 d.d* ..	2,100	1,484	..	£481,933		3,695,281	37,948,671	*6 motor-buses. Data to March 31, 1911	87
.62	4ft. 8½in.	100	26 d.d. (6 bogie cars)	*	..	..	£148,170	*	666,364	7,274,398	*Lighting and traction station. Data to Mar. 31, 1910	88
.2.8	3ft. 6in.	90	13 d.d. ..	1,000*	600	..	£47,745	*	254,035	1,765,454	* Energy purchased from Derbyshire and Notts. Electric Power Co. Data to March 31, 1911	89
.9.8	3ft. 6in.	90	36 d.d. ..	*	..	..	£114,470	*	676,255	5,240,242	* Lighting and traction station. Data to Mar. 31, 1911	90
.8	3ft. 0in.	56 & 62½	39 mr., 18 tr. (s.d. comb.)	1,300	1,337	347 KW.	..	..	360,083 (train miles)	533,104	Data to Sept. 30, 1910	91
.5	3ft. 6in.	36	2 automob.									
.5	4ft. 8½in.	65	8 d.d. ..	200	..	..	£41,445	..	36,385	196,088	Open in summer only. Data to October 31, 1910 ..	
.1.5	3ft. 6in.	90	59 d.d. ..	1,500*	1,200 (inc. lg.)	60 KW.	..	*	720,350	4,581,506	* Lighting and traction station. Data to Sept. 30, 1910	92
.54	4ft. 8½in.	95	10 d.d. ..	*	..	..	£68,731	*	168,840	1,222,795	*Energy purchased from County of Durham E.P.D. Co. and South Shields Corp. Data to Dec. 31, 1910	93
.27	4ft. 0in.	95	12 d.d., 2 motor buses	200*	160	..	£46,000	£42,000*	167,915 (9 months)	1,429,387 (9 months)	*Lighting and traction; 200 KW. for traction. Year ends Mar. 31, 1909	94
.6	3ft. 6in.	75	4 d.d., 9 s.d.	*	..	..	£60,851	*	177,491	671,258	*Energy purchased from Kidderminster & Dist. Elec. Lighting & Traction Co., Ltd.	95

	Locality.	Lines Owned
96	KILMARNOCK	Kilmarnock Corpora
97	KIRKCALDY	Kirkcaldy Corporatio
98	LANCASTER	Lancaster Corporatio
99	LEAMINGTON & WARWICK	Leamington and W trical Co., Ltd.
100	LEEDS	Leeds Corporation ..
101	LEICESTER	Leicester Corporatio
102	LEITH	Leith Corporation ..
103	LEYTON	Leyton Urban Distri
104	LINCOLN AND BRACEBRIDGE	Lincoln Corporation
105	LIVERPOOL	Liverpool Corporatio
106	LIVERPOOL—PRESCOT ..	Lancashire Light Rai
107	LLANDUDNO, RHOS-ON-SEA & COLWYN BAY	Llandudno and Colw tric Railway, Limi
108	LONDON (COUNTY)	London County Cour
109	LOWESTOFT	Lowestoft Corporatio
110	LUTON	Balfour, Beatty & Co.
111	MAIDSTONE	Maidstone Corporatio
112	MANCHESTER	Manchester Corporat
113	MANSFIELD & DISTRICT ..	Mansfield & Dist. Lt. trolled by M. & Di
114	MERTHYR TYDFIL	Merthyr Electric T Lighting Co., Ltd.
115	MEXBOROUGH, RAWMARSH & SWINTON	Mexborough & Swinto Co.
116	MIDDLESBROUGH, STOCKTON & THORNABY	Imperial Tramways C
117	MIDDLESEX & HERTFORDSHIRE	Metropolitan Electri Ltd.
118	MIDDLETON, ROCHDALE AND OLDHAM	Middleton Electric T Ltd.
119	MUSSELBURGH & DISTRICT	Musselburgh and Dis Light and Traction
120	NELSON	Nelson Corporation
121	NEWCASTLE-ON-TYNE ..	Newcastle-on-Tyne C
122	NEWPORT (MON.)	Newport Corporation
123	NORTHAMPTON	Northampton Corpor
124	NORWICH	Norwich Electric Tra
125	NOTTINGHAM	Nottingham Corporat
126	OLDHAM	Oldham Corporation
127	OLDHAM, ASHTON & HYDE	Oldham, Ashton & H Tramway, Ltd.
128	PAISLEY, JOHNSTON, RENFREW, BARRHEAD	Paisley District Tram
129	PENGE, SUTTON, WALL'N., MITCHAM, TTG., W.CR'N.	South Metropolitan E ways and Lighting
130	PERTH	Perth Corporation ..
131	PETERBOROUGH	Peterborough Electr Co., Ltd.
132	PLYMOUTH	Plymouth Corporatio
133	PLYMOUTH, STONEHOUSE AND DEVONPORT	Plymouth, Stonehous port Tramways Co.
134	PONTYPRIDD	Pontypridd Urban Council
135	PORTSMOUTH	Portsmouth Corporati
136	POTTERIES	Potteries Electric Trac
137	PRESTON	Preston Corporation
138	PURBROOK, COSHAM, W'VILLE AND HORNDEAN	Provincial Tramways
139	RADCLIFFE	Bury Corporation ..
140	RAWTENSTALL & BACUP	Rawtenstall Corporati
141	READING	Reading Corporation
142	RHONDDA (URBAN DISTRICT)	Rhondda Tramways C
143	ROCHDALE, LITTLEBOROUGH & HEYWOOD	Rochdale Corporation
144	ROTHERHAM	Rotherham Corporati
145	ROTHESAY	Rothesay Tramways C
146	ST. HELENS & DISTRICT ..	St. Helens Cor. (lease Helens & Dist. Tramw
147	SALFORD	Salford Corporation
148	SCARBOROUGH	Scarborough Tramway
149	SEAFORTH, WATERLOO & CROSBY	Liverpool Overhead E
150	SHEERNESS & QUEENBOROUGH	Sheerness and Distr Power and Traction
151	SHEFFIELD	Sheffield Corporation
152	SHIPLEY	Shipley Urban District
153	SMETHWICK	Birmingham and Mid ways, Ltd.
154	SOUTHAMPTON	Southampton Corpora
155	SOUTHEND-ON-SEA ..	Southend Corporation
156	SOUTH LANCASHIRE ..	South Lancashire Tra
157	SOUTHPORT	Southport Corp. (par Southport & Birkdale
158	SOUTHPORT & BIRKDALE	Southport Tramways C
159	SOUTHPORT PIER	Southport Pier Co., L
160	SOUTH SHIELDS	South Shields Corpora
161	SOUTH STAFFORDSHIRE*	South Staffs. Tramway
162	STALYBRIDGE, HYDE, MOSSLEY, DUKINFIELD	Stalybridge, Hyde, M Dukinfield Tr. & Ele
163	STOCKPORT & DISTRICT	Stockport Corporation
164	SUNDERLAND	Sunderland Corporatio
165	SUNDERLAND DISTRICT ..	Sunderland District El ways, Ltd.
166	SUTTON AND HOWTH ..	Great Northern Ry. C
167	SWANSEA	Swansea Improvement way Co.
168	SWINDON	Swindon Corporation
169	TAUNTON	Taunton Electric Tra Ltd.
170	TORQUAY	Torquay Tramways Co.
171	TYNEMOUTH & DISTRICT	Tynemouth and Distri Traction Co., Ltd.
172	TYNESIDE	Tyneside Tramways & Co.
173	WAKEFIELD & DISTRICT	Wakefield & District E way Co.
174	WALLASEY	Wallasey Corporation
175	WALSALL	Walsall Corporation
176	WALTHAMSTOW	Walthamstow Urban Council
177	WALTON-ON-THE-NAZE PIER	Coast Development Co Ltd.
178	WARRINGTON	Warrington Corporation
179	WEMYSS & DISTRICT ..	Wemyss and District Co., Ltd.
180	WEST BROMWICH	South Staffordshire (L
181	WEST HAM	West Ham Corporation
182	WEST MIDDLESEX, THAMES VALLEY & WIMBLEDON	London United Tramw
183	WESTON-SUPER-MARE ..	Weston-super-Mare an Electric Supply Co., L
184	WIGAN	Wigan Corporation
185	WOLVERHAMPTON	Wolverhampton Corpo
186	WOLVERHAMPTON DISTRICT	Wolverhampton Distri Tramways, Ltd.
187	WORCESTER	Worcester Electric Tra
188	WREXHAM	Wrexham and Distric Tramways, Ltd.
189	YARMOUTH	Yarmouth Corporation
190	YORK	York Corporation ..
191	YORKSHIRE (WOOLLEN DISTRICT)*	Yorkshire (W. D.) Elec ways, Ltd.

ELECTRIC RAILWA

Year of Opening.	Manager.	Electrical Engineer.	Consulting Engineers.	Length of Route in Miles.	Average distance between Stations, miles.	Average Schedule Speed, miles per hour.	Weight of Rails per Yard. Running.	Weight of Rails per Yard. Conductor.	No. of Motor Cars.	No. of Trailers.	Power Station Capacity, Kilowatts.	Maximum Load Recorded, Kilowatts.	Maximum Output of Battery.	System of Generation.	Lin
1900	H. F. Parshall'.. .. (Chairman)	E.P. Grove (Chief Eng.)	Basil Mott	7 7.36 authorised	0.5	15	100 lb.	85 lb.	64	172	7,600	..	..	5,000 v., 25~, 3-ph.	3rd rail ..
1899	T. C. Jenkin	P. V. McMahon ..	Basil Mott & David Hay	7.33	0.523	14.3	80 lb. & 80 lb.	40 lb.	52 locos.	165 coaches	3,850	2,600	..	500, 1,000 & 2,000 v. D.C. ..	3rd rail ..
1904	R. P. Brousson ..	R. P. Brousson ..	Sir Douglas Fox & Partners	3.42	0.684	16.24	85 lb.	80 lb.	32	44	3,440	2,120	..	550 v. D.C.	3rd and 4t

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, RAILWAYS AND POWER COMPANIES

OM.

Lines Owned by	Year of opening.	Tramways Manager.	Tramways Electrical Engineer.	Miles of Route.	Gauge.	Weight of Rails per yard, lb.	Motor Cars.	Power Station. Total Capacity in KW.	Power Station. Max. load in KW.	Power Station. Battery max. discharge.	Capital Outlay on Tramway and Rolling Stock.	Capital Outlay on Power Station.	Annual Electric Car Mileage.	Passengers Carried per Annum.	Remarks.	
ock Corporation	1904	Alf. H. Burbidge	Alf. H. Burbidge	4.29	4ft. 8½in.	90	14 d.d. ..	755*	199	..	£55,580	*	299,000	2,061,000	*Lighting and traction station. Data to May 15, 1911..	96
y Corporation	1903	O. F. Francis ..	O. F. Francis ..	6.14	3ft. 6in.	87	22 d.d. ..	1,090*	385	200 KW.	£89,500	£66,675*	430,160	4,643,604	*Lighting & traction station. Tramways extended to Dysart, opened Jan., 1911. Data to May 15, 1910	97
r Corporation	1903	Geo. C. Milnes..	Geo. C. Milnes..	4	4ft. 8½in.	90	12 d.d. ..	1,250*	700	..	£43,330	£37,600*	171,589	1,375,136	*Lighting and traction station. Data to Mar. 25, 1911	98
gton and Warwick Elec- Co., Ltd.	1905	R. L. McCulloch (Eng. & Man.)	R. L. McCulloch	3.05	3ft. 6in.	..	12 d.d. ..	630	..	..	..	£106,411	179,344	1,082,491	Data to Dec. 31, 1908	99
rporation	1897	J. B. Hamilton	J. Burbridge ..	57.5	4ft. 8½in.	100 & 105	281 d.d., 1 s.d.	5,900	4,961	..	£1,234,955*	£197,486	8,238,228	80,806,270	*Including purchase of lines. Data to Mar. 31, 1911 ..	100
Corporation	1904	A. F. Lucas ..	T. R. Smith .. (Tram. Eng.)	20	4ft. 8½in.	100	140 d.d., 3 water	2,500	1,600	450 KW.	£692,323	£98,426	3,546,724	29,370,699	Data to Dec. 31, 1910	101
rporation	1905	F. A. Fitzpayne (Gen. Manager).	A. Peden Rutherford(Bor.El.Eng.)	9	4ft. 8½in.	100.7	37 d.d. ..	2,232*	320	..	£234,975	..	953,556	8,246,617	*Lighting and traction station. Data to May 15, 1911..	102
Urban District Council ..	1906	F. Schofield ..	F. Harman Lewis	9.5	4ft. 8½in.	105	60 d.d. ..	2,700*	1,759	450 KW.	£308,317	£91,000*	1,472,929	14,260,980	*Lighting and traction station. Data to March 31, 1911	103
Corporation	1905	Stanley Clegg ..	Stanley Clegg ..	1.75	4ft. 8½in.	100	8 d.d. ..	290* (tr.only)	185 (tr. only)	..	£44,997	£67,410*	160,186	1,649,587	"G.B." surf. cont. system. *Lg. & tr. station. Energy purchased from Electricity Dept. Data to Mar. 31, 1911	104
l Corporation	1898	C. W. Mallins ..	A.B.Holmes(Cons.) A. Clough (Res.)	62.5	4ft. 8½in.	95, 110 & 123	537 d.d., 12 s.d.	37,000*	18,071	..	£1,986,531	£2,138,034*	12,235,408	125,507,283	*Lighting and traction stations. Energy purchased from Electricity Supply Dept. Data to Dec. 31, 1910	105
ire Light Railway Co., Ltd.	1902	E. H. Edwardes	E. H. Edwardes	3	4ft. 8½in.	90	7 d.d. ..	*	..	..	£50,832	*	108,060	493,087	*Energy purchased from Prescot lighting and traction station. Data to Dec. 31, 1910	106
no and Colwyn Bay Elec- ilway, Limited County Council	1907	J. W. McInnes..	.. .. ..	6.60	3ft. 6in.	90	18 s.d. ..	*	..	..	†	*	260,872	1,424,045	*Energy purchased from Llandudno U.D.C. †Not at present ascertainable. Data to Nov. 30, 1910	107
	1908	A. L. C. Fell ..	.. .. ..	85.83	4ft. 8½in.	102 & 105	1120 d.d., 50 s.d.	24,000	17,000	..	£6,305,400 (estd.)	£600,000 (to date)	31,962,784	344,705,987	Data to Mar. 31, 1909	108
t Corporation	1903	G. A. Bruce ..	G. A. Bruce ..	4	3ft. 6in.	100	15 d.d., 4 s.d.	*	..	..	£79,235	*	329,958	2,377,316	*Lighting and traction station. Energy purchased from Electricity Supply Dept. Data to Sept. 30, 1910	109
Beatty & Co., Ltd., Lessees	1908	J. W. McInnes..	W. H. Cooke (Boro' El. Eng.)	5.25	4ft. 8½in.	95	12 d.d. ..	1,150*	..	..	£63,000	*	..	..	*Energy purchased from Luton Corporation. Data to April 31, 1911	110
e Corporation	1904	A. T. Lambert ..	A. T. Lambert ..	5.25	3ft. 6in.	96	17 d.d., 1 s.d., 1 wtr.†	300*	280	150 KW.	£81,708	£55,000*	309,476	2,161,929	*Ltg. and tr. stn. Energy pur. from Electy. Dept. †1 s.d. demi., 3 d.d. regen. Data to Mar. 31, 1910	111
ter Corporation	1901	J. M. McElroy..	J. J. McMahon..	105	4ft. 8½in.	105	555 d.d., 45 comb.	*	..	..	£1,981,160	*	17,367,200	165,800,077	*Lighting and traction stations. Energy purchased from Electricity Committee. Data to March 31, 1911	112
& Dist. Lt. Ry. Co. (con- by M. & Dist. Tys. Ltd.) Electric Traction and g Co., Ltd.	1905	C. R. Walker ..	C. R. Walker ..	12.25	4ft. 8½in.	90	22 d.d. ..	*	..	..	£126,266	*	443,533	2,968,085	*Energy purchased from Mansfield Corporation. Data to Dec. 31, 1910	113
	1901	L. W. Dixon (Man. & Eng.)	T. H. Johnson(El. Eng.)*	3.04	3ft. 6in.	75	4 d.d., 12 s.d.	820	401 (tr. only)	300 KW.	£60,500	£53,153	237,875	1,960,672	Lighting and traction station. *H. King (Tr. Supt.) Data to Dec. 31, 1909	114
gh & Swinton Tramways	1907	Percy Priestly ..	Percy Priestly ..	7	4ft. 8½in.	90	20 d.d. ..	450	..	..	..	..	..	..	.. ..	115
Tramways Co.	1898	..	.. .. ..	9	3ft. 6in.	92.5	50 d.d., 10 comb.	900	..	..	..	..	..	10,000,000 approx.	.. ..	116
itan Electric Tramways,	1904	J. Devonshire .. (Man. Dir.)	A. H. Pott ..	55.4	4ft. 8½in.	101	276 d.d., 16 s.d.	*	..	..	..	*	8,761,837	76,460,980	*Energy purchased from North Metropolitan Electric Power Supply Co. Data to Dec. 31, 1910	117
n Electric Traction Co.,	1902	W. F. Endean ..	.. .. ..	8.5	4ft. 8½in.	90	5 d.d., 18 s.d., 4 comb.	*	..	..	£159,266	*	424,155	2,673,453	*Energy purchased from Middleton Corporation. Data for 1910	118
rgh and District Electric nd Traction Co., Ltd.	1904	A. A. Watkins	A. A. Watkins ..	6.5	4ft. 8½in.	90	16 d.d. ..	600*	400	..	£132,481	*	406,740	2,330,474	*Lighting & traction station. Data o Dec. 31, 1911 ..	119
rporation	1903	D. Helme ..	D. Helme ..	2.75	4ft. 0in.	107	6 d.d., 3 s.d. comb.	1,000*	..	..	£35,000	*	203,708	2,118,878	*Lighting and traction station. Data to March 31, 1911	120
e-on-Tyne Corporation..	1901	Ernest Hatton ..	Ernest Hatton ..	31.3	4ft. 8½in.	101	126 d.d., 60 s.d.	5,150	3,300	1,200 KW.	£968,831	£201,403	4,437,639	45,335,207	Data to March 31, 1911	121
Corporation	1903	H. Collings Bishop	H. Collings Bishop	7.5	4ft. 8½in.	96	43 d.d. ..	3,600*	2,350	750 KW.	£190,261	£100,000*	900,000	8,500,000	*Lighting and traction station. Energy purchased from Lighting Dept. Data to March 31, 1910	122
pton Corporation ..	1904	J. Gottschalk ..	John F. Cameron	5.5	3ft. 6in.	90	24 d.d. ..	520	350	150 KW.	£115,165	£12,957	586,850	5,857,292	Data to Mar. 31, 1911	123
Electric Tramways Co...	1900	F. W. Ketley ..	F. W. Ketley ..	14.62	3ft. 6in.	65.5 & 90	42 d.d. ..	800	500	..	£330,000		1,034,092	7,989,035	Data to June 30, 1910	124
am Corporation	1901	J. Aldworth ..	H. Talbot ..	19	4ft. 8½in.	107	135 d.d. ..	8,576*	..	100 KW.	£613,863	*	3,340,549	34,647,238	*Lighting & traction station. Data to Mar. 31, 1911 ..	125
Corporation	1900	J. W. Dugdale ..	S. W. Newington	23	4ft. 8½in.	100	57 d.d., 23 s.d.	2,565*	1,485	..	£440,423	£223,341*	1,978,150	20,082,367	*Lighting and traction station. Data to Mar. 25, 1908..	126
Ashton & Hyde Electric ay, Ltd. istrict Tramways Co. ..	1899	J. V. Kitchener (Man. Dir.)*	E. T. Todd ..	9.13	4ft. 8½in.	96	12 d.d., 34 s.d.	†	..	..	£158,942	†	767,603	5,508,462	*A. Anderson, Supt. †Energy purchased from Ashton Corporation. Data to Dec. 31, 1910	127
	1904	Fred Coutts ..	Fred Coutts. H. F. Parshall(Cons.)	20	4ft. 7½in.	90 & 95	56 d.d., 2 s.d.	*	500	..	..	*	1,200,000	14,000,000	*Energy purchased from Clyde Valley Co., and Paisley Corporation. Data to April 27, 1911	128
tropolitan Electric Tram- d Lighting Co., Ltd.	1906	A. V. Mason (Gen. Man.)	A. V. Mason ..	13.09*	4ft. 8½in.	90	51 d.d. ..	600 (tr. only)	200 (tr. only)	..	£405,364	£81,437	937,213	6,982,483	Lg. & tr. st. Energy also purch. from C'n. and Beck'm. *Also 2.6 m. thro' rg. Croydon. Data to Dec. 31, 1910	129
rporation	1905	John Lambert ..	John Lambert ..	5.8	3ft. 6in.	90	12 d.d. ..	1,175*	200	..	£55,919	£59,480*	245,610	1,697,008	*Energy purchased from Perth Corporation. Data to May 15, 1910	130
ugh Electric Traction d.	1908	J. R. Groves ..	..	5.31	3ft. 6in.	94	14 d.d. ..	*	..	..	£62,897	*	240,317	1,171,411	*Energy purchased from Peterborough Corporation.	131
Corporation	1899	C. R. Everson ..	E. G. Okell ..	4.1	3ft. 6in.	92	26	700*	..	1,140 KW.-hrs.	£117,000	*	..	..	*Lighting and traction station	132
, Stonehouse & Devon- amways Co. d Urban District	1901	G. H. Moreton ..	John Glenn ..	1.5	3ft. 6in.	84	14 d.d. ..	*	..	..	..	*	..	..	*Energy purchased from Devonport Corporation ..	133
	1905	J. E. Teasdel ..	J. E. Teasdel ..	5.35	3ft. 6in.	93	20 d.d., 6 s.d.	1,400*	490 (tr.)	495 KW.	£131,543	£44,251*	450,118	4,917,224	*Lighting and traction. Energy purchased from Corp. Elec. Dept. at 1½d. per unit. Data to Mar. 31, 1910	134
th Corporation	1901	W. R. Spaven ..	V. G. Lironi ..	15.75	4ft. 7¾in.	96 & 100	100 d.d. ..	2,075	974	..	£599,459*	£51,368	2,155,530	22,960,173	*Including purchase. Data to Mar. 31, 1911	135
Electric Traction Co., Ltd	1899	W. Thom ..	F. J. Chapple ..	31.68	4ft. 6in.	87 & 110	110 s.d. ..	2,100	..	..	£528,285		2,358,372	17,838,197	Data for 1908	136
orporation	1904	Jos. F. Simpson	Jos. F. Simpson	10	4ft. 8½in.	95	30 d.d. ..	600	450	..	£187,000		901,374	8,484,589	Data to Mar. 31, 1911	137
l Tramways Co., Ltd. ..	1903	J. Fereday Glenn	J. Fereday Glenn J. Glenn (Cons.)	6	4ft. 7¾in.	96	16 d.d. ..	200*	..	500 A.	..	..	247,219	830,764	J. B. Glenn, Sec. and Man. Dir. *Diesel oil engines. Data to Sept. 30, 1910	138
oration	1905	W. Clough ..	H. Wilkinson ..	..	4ft. 8½in.	100	..	490*	310 (tr. only)	..	..	*	365,635	2,978,109	†Lg. and tr. Energy supplied by Radcliffe U.D.C.; tramways worked by Bury Corporn. Data to Mar. 31, 1910	139
ll Corporation	1909	C. L. E. Stewart	C. L. E. Stewart	11.75	4ft. 0in.	100	16 d.d., 6 s.d., 16 regen.	830*	500	140 KW.	£170,593	£37,574	446,195	3,236,730	*Energy purchased from Electricity Dept. Data to Mar. 31, 1911	140
Corporation	1903	Walter Binns ..	Walter Binns ..	7.5	4ft. 0in.	96	36 d.d. ..	400	500	..	£196,000	£30,000 (exc. site)	909,349	7,834,575	Data to Mar. 31, 1911	141
Tramways Co., Ltd. ..	1908	H. J. Nisbett ..	H. J. Nisbett ..	18.5	3ft. 6in.	96	50 d.d. (25 covd.)	1,320*	1,110	..	£250,000	£55,000*	1,094,571	9,036,645	*Energy purchased from the Rhondda Tramways Elec. Sup. Co., Ltd., at 1.012d. p. unit, inc. Data to Dec. 31, '10	142
Corporation	1902	J. S. D. Moffet	C. C. Atchison.. (Boro' El. Eng.)	19.58	4ft. 8½in.	103	34 d.d., 25 comb.	2,176*	517 (tr. only)	..	£348,629†	£66,414	1,275,351	10,428,065	*Lg. & tr. st. †Inc. £75,000, purchase of Bury, Rochdale & Oldham Trys. in Rochdale dist. Data to Mar. 31, 1910	143
n Corporation	1903	Edward Cross ..	Edward Cross ..	10.21	4ft. 8½in.	88.5 & 105	35 d.d., 1 water	1,650*	660	..	£152,644	£58,090*	722,390	6,960,178	*Lighting and traction station; plant available for both purposes. Data to Mar. 31, 1911	144
Tramways Co., Ltd. ..	1902	A. Robertson ..	H. H. Hill ..	4.87	3ft. 6in.	97	20	350	..	350 A.H.	£143,103		223,221	1,070,807	Data for 1910	145
s Cor. (leased to New St. Dist. Tramway Co., Ltd.) rporation	1900	C. D. Stanley ..	E. M. Hollingsworth	20	4ft. 8½in.	92	44 d.d. ..	*	..	..	£30,000	*	1,112,547	6,054,865	*Energy purchased from St. Helens Corporation. Data to Dec. 31, 1910	146
	1901	G. W. Holford ..	N. J. Hawkins	41	4ft. 8½in.	103	190 d.d., 10 comb.	6,400*	..	1,200 A.H.	£71,588	*	5,824,474	46,659,353	*Lighting and traction station. Data to March 31, 1911	147
gh Tramways Co. ..	1904	Walter E. Nicoll	Walter E. Nicoll	4.78	3ft. 6in.	90	22 d.d., inc. 7 regen.	*	..	..	£99,580	*	187,677	1,191,217	*Energy purchased from Scarborough Electric Supply Co. Data to Dec. 31, 1910	148
Overhead Railway Co.	1900	E. J. Neachell ..	E. J. Neachell ..	2.5	4ft. 8½in.	92½	12 d.d., 2 s.d.	160* (substn.)	..	1,300 A.H.	£28,917	*	275,112	2,351,110	*Energy from Liverpool Overhead Ry. power station. Data to Dec. 31, 1910	149
and District Electric nd Traction Co., Ltd. Corporation	1903	G. L. Kirk ..	G. L. Kirk ..	2.5	3ft. 6in.	94	8 d.d. ..	700*	346	..	£33,769	£51,696*	106,249	734,996	Bow collector. *Lighting and traction station. Data to Dec. 31, 1909	150
	1899	A. R. Fearnley ..	H. E. Yerbury ..	40	4ft. 8½in.	110	211 d.d.,53 s.d., 16 st. cars, etc.	5,725	4,500	..	£1,158,488*	£106,197*	7,618,383	84,500,331	*Data to Mar. 25, 1910; other data to Mar. 25, 1911 ..	151
rban District Council*	1902	C. J. Spencer ..	S. D. Schofield..	6	4ft. 0in.	98	*	1,170†	702 KW.	150 KW.	..	£65,341	*	*	*Leased to Bradford Corporation. †Lighting and traction station. Data to Mar. 31, 1910	152
am and Midland Tram- td.	1904	W. G. Bond ..	R. Humphries (try S.A. Mahood (pr.).	12.10	3ft. 6in.	90 & 94	50 d.d., 6 s.d.	6,500*	3,000	14.5 KW.	£351,586	£115,228*	1,018,905	11,081,093	*Lighting and traction station. Data to Dec. 31, 1910..	153
ton Corporation ..	1900	H. F. Street ..	H. F. Street ..	11	4ft. 8½in.	98	49 d.d. ..	1,360*	..	1,500 KW.	£200,678	*	1,157,451	10,121,887	*Lighting and traction station. Data for 1907-8 ..	154
Corporation	1901	Robert Birkett..	Robert Birkett ..	7	3ft. 6in.	90	31 d.d. ..	*	540	..	£110,000 (approx.)	*	562,366	6,311,541	*Lighting and traction station. Traffic superintendent, J. Daniels. Data to Mar. 31, 1911	155
ncashire Tramways Co.	1902	E. H. Edwardes	E. H. Edwardes	39	4ft. 8½in.	90	82 d.d., 1 s.d.	2,750*	1,500	..	£508,000	£90,000*	2,147,608	12,954,754	*Lighting and traction station. Data to Dec. 31, 1910..	156
Corp. (part leased to & Birkdale Tram. Co.) Tramways Co., Ltd. ..	1900	J. Lloyd.. ..	H. Bentham ..	Cor. 8.5 Co. 8.17	4ft. 8½in.	87, 90, & 101	17 d.d., 1 s.d. 8 comb.	2,350*	1,435	600 KW.	£84,104	*	404,128	2,812,910	*Lighting and traction station. Data to Dec., 1910	157
	1901	J. Lloyd.. ..	H. Bentham ..	8.17	4ft. 8½in.	87	20 d.d.(1 regen.) 1s.d.(demi-car)	*	..	..	£84,110 Coy. £74,000 Cor.	*	402,533	2,812,910	†Energy purchased from Southport Corp. and Birkdale Dist. Elec. Supply Co., Ltd. Data to Dec. 31, 1910	158
Pier Co., Ltd.	1905	W. H. Scott ..	.. .. ..	0.6	3ft. 6in.	..	3 s.d. ..	*	..	..	..	*	..	..	Third-rail system. *Energy supplied by Southport Corporation	159
lds Corporation ..	1906	Pier & Tram. Man. Lionel E. Harvey	J. H. Cawthra ..	10.25	4ft. 8½in.	95	35 d.d. ..	1,100tr.*	..	..	£172,355	*	808,062	7,275,813	*Lighting and traction station. Data to Mar. 31, 1911	160
s. Tramways Lessee Co.	1902	W. G. Bond (Gen. Man.)	.. .. ..	18.30	3ft. 6in.	90 & 96	29 d.d. ..	†	..	..	£160,867	†	1,076,744	8,640,608	*W. Bromwich, Wednesbury, Dudley, Tipton, Handsworth, Darlaston. †Energy purchd. Data to 31.12. '09	161
e, Hyde, Mossley and ld Tr. & Elec. Board Corporation	1904	Frank Schofield	R. Blackmore ..	21	4ft. 8½in.	99	40 d.d., 10 s.d., 10 comb.	7,500*	5,500	750 A.H.	£278,866	£235,468*	1,295,018	10,190,944	*Lighting and traction station. Energy supplied at 1½d. per unit. Data for 1907-8	162
	1901	A. T. Eardley ..	R. Lomax ..	15.5	4ft. 8½in.	105 & 99	50 d.d. ..	1,600*	900	..	£191,336	£39,099*	..	..	*Lighting & traction station. Energy supplied at 1½d. per unit. Data for 1907-8	163
l Corporation	1900	A. R. Dayson ..	A. R. Dayson ..	20	4ft. 8½in.	96	58 d.d., 8 s.d., 4 comb.	*	..	..	£299,744	*	1,451,906	14,561,672	*Energy purchased from Corporation Electricity Department. Data to Mar. 31, 1911	164
l District Electric Tram- d. hern Ry. Co. (Ireland)	1905	G. Stratton ..	G. Stratton ..	14.5	4ft. 8½in.	90	33 d.d. ..	*	..	..	..	*	638,982	3,519,616	*Energy purchased from Durham Collieries Electric Power Co. Data to Oct. 31, 1910	165
	1901	H. Plews (Gen. Man. G.N.R.I.)	A. W. Whieldon	5.37	5ft. 3in.	72	10 d.d., 1 s.d.	475	470	150 KW.	..	..	85,000	..	Feeder for steam line from Dublin to Howth. F. A. Campion, Chief Engineer.	166
mprovements & Tram-	1900	D. James ..	A. Johnston ..	12.43*	4ft. 8½in.	87 & 95	23 d.d., 30 s.d. 12 comb.	640	597	..	£261,791 inc. purch.	..	1,167,571	9,762,646	*7 miles leased, and part of energy purchased, from Swansea Corporation. Data to Dec. 31, 1910	167
orporation	1904	T. Medcalf ..	A. Dimmack ..	3.7	3ft. 6in.	105	12 d.d. ..	900*	200 (tr. only)	..	£44,177	*	214,795	2,058,617	*Lighting and traction station. Energy purchased from Elec. Department. Data to March 31, 1911	168
Electric Traction Co.	1901	C. W. Durnford	.. .. ..	1.66	3ft. 6in.	90	6 s.d. ..	*	..	..	£30,651	*	109,709	518,554	*Energy purchased from Taunton Corporation. Data to Dec. 31, 1909	169
ramways Co., Ltd. ..	1907	Harry Holliday	.. .. ..	8.41	3ft. 6in.	90	18 d.d. ..	*	..	..	..	*	382,809.48	2,876,463	*Energy purchased from Torquay Corporation. Data to Dec. 31, 1910.	170
and District Electric Co., Ltd.	1901	R. Simpson ..	.. .. ..	4.21	3ft. 6in.	90	21 d.d. ..	*	..	..	£97,915	*	282,030	2,056,390	*Energy purchased from Tynemouth Corporation. Data to Dec. 31, 1910	171
Tramways & Tramroads	1902	J. C. Little .. (Sec. & Res. Man.)	F. H. Briggs ..	11	4ft. 8½in.	95	24 d.d. ..	*	..	..	£207,489	*	697,218	4,475,721	*Energy supplied by Newcastle-upon-Tyne Elec. Supply Co., Ltd., & Tynemouth Corp. Data to Dec. 31, 1910	172
& District Light Rail-	1904	H. England ..	C. J. Jewell ..	24.69	4ft. 8½in.	96	67 d.d. ..	1,600	1,431	100 KW.	£701,761	£52,901	1,770,028	9,220,853	Data to Dec. 31, 1910	173
orporation	1902	R. R. Greene ..	J. A. Crowther ..	8.72	4ft. 8½in.	98	50 d.d. ..	1,100*	835	440 KW.	£176,159	£108,000	945,948	9,387,665	*Lighting and traction station. Data to Mar. 31, 1910..	174
poration	1904	R. L. Horsfield..	A. S. Barnard ..	13.5	3ft. 6in.	90 & 92	32 d.d. ..	1,730*	1,026	..	£165,086	£17,000*	655,321	5,184,620	*Lighting and traction station. Energy purchased from Walsall Corporation. Data to Dec. 31, 1910	175
ow Urban District	1905	Wm. Murray ..	G. R. Spurr ..	9	4ft. 8½in.	100	32 d.d. ..	*	..	..	£180,000	*	879,756	10,641,127	*Lighting and traction station; gas power. Data to Mar. 31, 1910	176
lopment Corporation,	1898	T. Faiers ..	E. A. Lambert ..	0.5	3ft. 6in.	36	1 motor car, 2 trailers	..	..	..	..	..	..	..	Third-rail pier electric railway. Energy purchased from Walton Elec. Supply Co.	177
Corporation	1902	J. Telfer ..	F. V. L. Mathias	6.5	4ft. 8½in.	90	21 d.d. ..	2,150*	1,301	800 A.H.	£102,146	£95,200*	436,654	5,071,154	*Lighting and traction station. Data to Mar. 31, 1911..	178
d District Tramways	1906	Major W. T. J. Marshall	R. Richardson ..	7.5	3ft. 6in.	95 & 97	17 s.d. ..	690	300	..	£78,000	*	350,473	1,860,000	*Energy purchased from Wemyss Coal Co., Ltd. Data to Dec. 31, 1910	179
ordshire (Lessee Co.)	1902	W. G. Bond ..	W. A. Jackson..	7	3ft. 6in.	97½	30 d.d. ..	1,550*	743 (tr. only)	150 KW.	£147,758	£65,315*	†	†	*Lighting and traction station. †See South Staffordshire Tramways. Data to March 31, 1911	180
Corporation	1904	H. E. Blain ..	.. .. ..	15.5	4ft. 8½in.	100	118 d.d., 2 water cars	11,400*	..	..	£516,500	..	2,908,000 (1909-10)	36,846,649 (1909-10)	*Lighting and traction station; energy supplied at 0.95d. per unit. Data to Mar. 31, 1910	181
ited Tramways, Ltd.	1901	A. H. Stanley ..	.. .. ..	55.5	4ft. 8½in.	92½ & 100	340 d.d. ..	3,500	..	..	..	..	8,614,982*	59,255,919	6 converter sub-stns.; 4 fed from L.U.T. stn., 2 from Lot's Rd. *Also 137,770 horse tr. Data to Dec. 31, 1908	182
er-Mare and District upply Co., Ltd. poration	1902	G. Charlton ..	G. Charlton ..	2.92	4ft. 8½in.	90	8 d.d., 4 s.d.	1,100*	369	576 A.	£127,015 inc.		131,626	1,103,002	*Lighting and traction station. Data to Dec., 1909 ..	183
	1901	James Slevin ..	James Slevin ..	24.87	3ft. 6in. & 4ft. 8½in.	105	13 d.d., 54 s.d.	1,140*	..	750 A.H.	£515,823	*	1,404,629	11,867,950	*Lighting and traction station. Data for 1907-8 ..	184
pton Corporation ..	1902	W. A. Luntley .. (Gen. Man.)	C. Shawfield(Cons.) H. Vickers(El. Eng.)	13.5	3ft. 6in.	91 & 96	34 d.d., 4 s.d. 11 comb.	2,900* (tr. only)	1,300	750 A.H.	£246,660	*	1,126,607	10,648,802	*Lighting and traction station. Energy from Elec. Com. Lorain surface-contact system. Data to Mar. 31, 1911	185
pton District Electric s, Ltd.	1900	W. G. Bond (Gen. Man.)	.. .. ..	14.70	3ft. 6in.	94	32 d.d. ..	*	..	..	£235,494	*	607,901	4,322,888	*Energy purchased from Dudley Corp. and Midland Elec. Corp. for Pr. Distribution. Data to Dec. 31, 1910	186
Electric Traction Co.	1904	J. R. Groves ..	.. .. ..	5.86	3ft. 6in.	94	15 d.d. ..	*	..	..	£116,625	*	323,668	2,820,164	*Energy purchased from Worcester Corporation. Data for 1910	187
and District Electric s, Ltd.	1903	A. A. Hawkins ..	.. .. ..	4.44	3ft. 6in.	97	10 d.d. ..	*	..	..	£57,289	*	143,427	852,770	*Energy purchased from Wrexham Corporation ..	188
Corporation	1902	F. L. Turner ..	G. Bryant ..	10.5	3ft. 6in.	90	35 d.d. ..	400*	..	200 KW.-hours	..	*	662,823	4,440,183	*Lighting and traction station. Data to Mar. 31, 1911	189
ration	1910	J. W. Hame ..	J. W. Hame ..	5.87	3ft. 6in.	100	22 d.d. ..	1,860	1,060	400 KW.	£127,000	..	458,365	3,864,161	Data to Mar. 31, 1911	190
W. D.) Electric Tram- .	1903	E. A. Paris .. (Man. Dir.)	.. .. ..	22.25	4ft. 8½in.	94	50 d.d., 16 s.d. 3 regen.	†	about 1,600	..	£329,480	†	1,321,918	9,540,988	*Dewsbury, Heckmondwike, Cleckheaton, Liversedge, Gomersal, Birstal, Birkenshaw, Batley, Thornhill, Ravensthorpe. †Energy purchased. Data to Dec.31,1910	191

AYS.

Line Equipment.	Line Pressure.	Capital Outlaid.	Annual Train Mileage.	Passengers carried per Annum.	Ratio of Expenses to Receipts.	REMARKS.	
3rd rail	550 volts D.C.	.. ..	1,807,396 (1910)	40,660,856 (1910)	56.11% (1910)	Separate tunnels. Four rotary-converter substations. Multiple-unit control, 7, 6, 5 and 3-car trains, 2-minute service (for small portion of day 1½-minute)	1
3rd rail	500 volts D.C.	£3,149,772	1,423,115	25,129,651	46.65%	First electric railway constructed. Separate unnels. Energy transmitted to substations at 1,000 and 2,000 volts D.C.	2
3rd and 4th rails	550 v. D.C. ..	£2,010,000 authorised	675,691	11,822,943	53.03%	Separate tunnels. Two conductor rails, feeder. Multiple-unit control	3
						Park Royal power station, built by G.W.R., also supplies power and light to	4

75 COSPORT & FAREHAM ..	Provincial Tramways Co., Ltd. ..	1903	J. Pereday Glenn	J. Pereday Glenn J. Glenn (Cons.)	7.18	4ft. 7½in.	95	22 d.d. ..	750*	..	..	(net) ..	..	470,851	2,098,714
76 GRAVESEND, NORTHFLEET AND SWANSCOMBE	Gravesend and Northfleet Electric Tramways, Ltd.	1902	P. N. Gray ..	.. .. ..	6.5	4ft. 8½in.	87	16 d.d., 2 s.d.	*	..	..	£98,646	*	301,389	2,472,176
77 GREENOCK AND PORT GLASCOW	Greenock & Port Glasgow Tramways Co.	1901	A. Robertson ..	.. .. ..	7.42	4ft. 7¾in.	92	40 (1 demi-car)	*	..	..	£237,771	*	784,647	7,278,253
78 CRIMSBY & CLEETHORPES	Gt. Grimsby Street Tramways Co.	1902	H. L. White ..	H. Orme White	6	4ft. 8½in.	90	32 d.d. ..	300	..	..	..	..	..	..
79 GUERNSEY ST. PETER PORT & ST. SAMPSON'S	Guernsey Railway Co., Ltd. ..	1892	A. G. Bird ..	A. G. Bird ..	3.5	4ft. 8½in.	40, 74 & 84	9 d.d., 1 s.d., 8 trailers	130	100	..	£27,632	..	Car 142,794 Tlrs. 24,072	864,310
80 HALIFAX	Halifax Corporation	1898	W. M. Rogerson	W. M. Rogerson	37.4	3ft. 6in.	95.5	93 d.d., 2 s.d.	4,750*	2,960	660 KW.	£399,269	£259,313*	1,894,362	16,957,212
81 HARTLEPOOL, EAST & WEST & SEATON CAREW	Hartlepool Electric Tramways Co., Ltd.	1896	George Cardwell	George Cardwell	6.72	3ft. 6in.	90	21 d.d. ..	400	360	..	£94,515		427,790	2,391,571
82 HASLINGDEN	Haslingden Corporation	1908	Barnes Kay ..	Barnes Kay ..	3	4ft. 0in.	100	*	†	..	100 KW.	£25,000*	£1,387† (sub. stn.)	149,612	1,188,643
83 HASTINGS, ST. LEONARDS AND BEXHILL	Hastings Tramways Co.	1905	Thos. B. Holliday	Thos. B. Holliday	19.3*	3ft. 6in.	90	65 d.d. ..	2,100	..	82 KW.	£488,300		1,402,000	8,652,210
84 HERNE BAY PIER	Herne Bay U. D. C.	1898	Henry C. Dufton	Henry C. Dufton	0.75	3ft. 0in.	60	3 s.d. ..	50	..	..	..	..	..	..
85 HEYWOOD	Heywood Corp. owner; Bury and Rochdale Corporations, lessees	1905	Jas. Stott ..	Jas. Stott ..	4.25	4ft. 8½in.	90	*	900†	800	..	£28,762	£6,496†	275,063	2,084,396
86 HUDDERSFIELD	Huddersfield Corporation	1901	R. H. Wilkinson	R. H. Wilkinson	28.5	4ft. 7¾in.	98 & 105	76 d.d. ..	2,200	1,870	..	£357,557	£50,769	3,058,663	19,001,660
87 HULL	Hull Corporation	1899	W. J. McCombe	J. Wilkinson ..	16	4ft. 8½in.	94	136 d.d* ..	2,100	1,484	..	£481,983		3,695,281	37,948,671
88 ILFORD	Ilford Urban District Council ..	1903	A. Woolstencroft (Traffic Sup.)	A. H. Shaw ..	6.62	4ft. 8½in.	100	26 d.d. (6 bogie cars)	*	..	..	£148,170	*	666,364	7,274,398
89 ILKESTON	Ilkeston Corporation	1903	H. P. Stokes ..	H. P. Stokes ..	3.8	3ft. 6in.	90	13 d.d. ..	1,000*	600	..	£47,745	*	254,035	1,765,454
90 IPSWICH	Ipswich Corporation	1903	F. Ayton ..	F. Ayton ..	10.8	3ft. 6in.	90	36 d.d. ..	*	..	..	£114,470	*	676,255	5,240,242
91 ISLE OF MAN: (1) DOUGLAS-RAMSEY (2) SNAEFELL MOUNTAIN	Manx Electric Railway Co., Ltd.	1893, '94 1898 1895	F. Edmondson (Gen. Man.)	F. Edmondson..	18 4.5	3ft. 0in. 3ft. 6in.	56 & 62½ 36	39 mr., 18 tr. (s.d. comb.) 2 automob.	1,300	1,337	347 KW.	..	..	360,083 (train miles)	533,104
(3) DOUGLAS SOUTHERN	Douglas Southern Electric Tramways, Ltd.	1896	R. Orton ..	R. Orton ..	3.5	4ft. 8½in.	65	8 d.d. ..	200	..	..	£41,445	..	86,985	196,088
92 ISLE OF THANET	Isle of Thanet Electric Tramways & Lighting Co., Ltd.	1901	J. A. Forde ..	J. A. Forde ..	11·5	3ft. 6in.	90	59 d.d. ..	1,500*	1,200 (inc. lg.)	60 KW.	..	*	720,350	4,531,506
93 JARROW AND DISTRICT ..	Jarrow & District Electric Traction Co., Ltd.	1906	W. Morrison (Man. Dir.)	G. McClelland (Supt.)	2.54	4ft. 8½in.	95	10 d.d. ..	*	..	..	£68,731	*	163,840	1,222,795
94 KEIGHLEY	Keighley Corporation	1904	D. Gray	J. M. Smyth .. (Power Station)	3.27	4ft. 0in.	95	12 d.d., 2 motor buses	200*	160	..	£46,000	£42,000*	167,915 (9 months)	1,429,387 (9 months)
95 KIDDERMINSTER AND STOURPORT	Kidderminster & Stourport Electric Tramway Co.	1898	A. Charlton (Eng. & Man.)	A. Charlton ..	4.6	3ft. 6in.	75	4 d.d., 9 s.d.	*	..	..	£60,851	*	177,491	671,258

ELE

Name of Railway.	Districts Served.	Year of Opening.	Manager.	Electrical Engineer.	Consulting Engineers.	Length of Route in Miles.	Average distance between Stations, miles.
1 CENTRAL LONDON RAILWAY	London: Shepherd's Bush (Wood Lane) to Bank. Extension to Liverpool St. under construction	1900	H. F. Parshall'.. .. (Chairman)	E.P. Grove (Chief Eng.)	Basil Mott	7 7.36 authorised	0.5
2 CITY & SOUTH LONDON ELECTRIC RAILWAY ..	London: Euston & King's Cross to City and Clapham Common	1890	T. C. Jenkin	P. V. McMahon ..	Basil Mott & David Hay	7.33	0.523
3 GREAT NORTHERN & CITY ELECTRIC RAILWAY..	London: Finsbury Park to City	1904	R. P. Brousson ..	R. P. Brousson ..	Sir Douglas Fox & Partners	3.42	0.684
4 HAMMERSMITH & CITY RAILWAY	London: Hammersmith & Addison Rd. to City	1906	J. C. Inglis	Roger T. Smith (G.W.R.)	Kennedy & Jenkin ..	4.71	0.511
5 LANCASHIRE & YORKSHIRE RAILWAY	Liverpool, Southport & Crossens; Liverpool, Aintree & Town Green	1904 (converted)	John A. F. Aspinall .. (Gen. Man.)	Geo. Hughes (Chief Mech. Eng.)	.. ..	40	1.135
6 LIVERPOOL OVERHEAD RAILWAY	Liverpool Docks	1893	E. J. Neachell	E. J. Neachell	.. ..	6.5	0.4
7 LONDON, BRIGHTON & SOUTH COAST RAILWAY	London: Victoria to London Bridge *via* Brixton..	1909 (Dec.) (converted)	William Forbes (Gen. Man.)	R. H. Houghton ..	Philip Dawson.. ..	8.7	1.08
	London: Victoria to Crystal Palace *via* Streatham Hill ..	1911 (May) (converted)					
8 LONDON ELECTRIC RAILWAY	London: Elephant & Castle & Waterloo to Baker Street & Gt. Central Railway and Edgware Road; Charing Cross to Hampstead & Golder's Green (branch line from Camden Town to Highgate); Finsbury Park to Hammersmith	1906 & 1907	A. H. Stanley	.. ..	.. ..	22.213	0.47
9 MERSEY ELECTRIC RAILWAY	Birkenhead & Liverpool	1903 (converted)	J. Shaw (Gen. Man.)	J. Shaw	.. ..	4.77	0.925
10 METROPOLITAN DISTRICT RAILWAY	London: Wimbledon, Hounslow, Ealing, South Harrow, Uxbridge & Richmond to Charing Cross, City, East Ham, Barking, etc.	1905 (converted)	A. H. Stanley	.. ..	.. ..	24.3*	0.65
11 METROPOLITAN RAILWAY	London: Baker Street to Uxbridge, & Inner Circle	1905 (converted)	R. H. Selbie (Gen. Man.)	Charles Jones	.. ..	26	0.71
12 MIDLAND RAILWAY	Lancaster, Morecambe and Heysham Harbour	1908 (converted)	W. G. Granet (Gen. Man.)	W. B. Worthington (Chief Eng.) Henry Fowler (Chief Mech. Eng.)	.. ..	9.5	3
13 NORTH-EASTERN RAILWAY	Newcastle & Tyneside	1904 (converted)	A. Kaye Butterworth (Gen. Man.)	W. Worsdell (R. S.), C. A. Harrison (P.W.)	Merz and McLellan ..	35*	1.25
14 WATERLOO & CITY ELECTRIC RAILWAY	London: Waterloo Station & City (Mansion House)	1898	Sir C. J. Owens (Gen. Man.)	Herbert Jones, M.I.E.E.	.. ..	1.5	1.5

ELECTRIC

Name of Power Company.	Districts Served.	Generating Stations.	Year of Opening.	Engineer and Manager.	Consulting E
1 CLEVELAND & DURHAM COUNTY ELECTRIC POWER CO.	North Riding of Yorkshire and part of Durham County (843 sq. miles) ..	Grangetown*	1904	A. B. Gridley (Man.) ..	Charles H. William McL
2 CLYDE VALLEY ELECTRIC POWER CO.	Parts of Lanark, Renfrew, Dumbarton and Stirling (750 sq. miles) ..	Yoker and Motherwell	1905	David A. Starr	Strain & Rober
3 CORNWALL ELECTRIC POWER CO.	County of Cornwall	Hayle. (St. Blazey and Phillack, proposed) ..	1911	L. A. Hards	Edmundson's Corporation,
4 COUNTY OF DURHAM ELECTRIC POWER SUPPLY CO.	County of Durham (250 sq. miles)	Energy supplied in bulk by Newcastle-upon-Tyne Electric Supply Co.	1902	.. ..	Charles H. William McL
5 DERBYSHIRE & NOTTINCHAMSHIRE ELECTRIC POWER CO. ..	County of Nottingham and part of the County of Derby (1,570 sq. miles)..	Ilkeston (Newark and Sutton-in-Ashfield, proposed)	1903	A. E. Loos (Gen. Man.)..	.. ..
6 DURHAM COLLIERIES ELECTRIC POWER SUPPLY CO.	Durham Colliery District*	Philadelphia	1906	W. S. Verrill (Res.) ..	†See "Remark
7 FIFE ELECTRIC POWER CO.	County of Fife..	Townhill	1905	J. S. Thomson (Gen. Man.)	.. ..
8 GLOUCESTERSHIRE ELECTRIC POWER CO.	County of Gloucester	Stroud and West Dean	..	.. ..	G. L. Addenbro
9 KENT ELECTRIC POWER CO.	County of Kent, except Isle of Thanet & area of West Kent Electric Co., Ltd.	Frindsbury	1907	H. B. Harvey (Man. and Engineer)	.. ..
10 LANCASHIRE ELECTRIC POWER CO.	Lancashire south of the Ribble, excluding Manchester, Salford, Stockport, part of Bolton, Liverpool and Bootle	Radcliffe	1905	C. D. Taite	H. F. Parshall
11 LEICESTERSHIRE & WARWICKSHIRE ELECTRIC POWER CO. ..	Counties of Leicester and Warwick (1,340 sq. miles)	(Newbold-on-Avon, Whitacre, Hinkley, Glenfield and Measham, proposed)	..	.. ..	.. ..
12 METROPOLITAN ELECTRIC SUPPLY CO., LTD.	Holborn, Westminster (part), Paddington, Hanwell, Southall-Norwood and Greenford Detached. BULK SUPPLIES to Acton and Uxbridge. BULK SUPPLY POWERS to St. Marylebone, Hampstead & Fulham; Ealing, Chiswick, Brentford, Heston & Isleworth, Twickenham, Teddington, Hampton, Staines; Rickmansworth, Slough, Eton, Wycombe (part), Windsor, Chertsey, Egham, Chesham, Maidenhead, Kingsbury, Harrow, Wealdstone, and Hendon	Willesden: Amberley Road..	..	J. S. Highfield	.. ..
13 MIDLAND ELECTRIC CORPORATION FOR POWER DISTRIBUTION, LTD.	Amblecote, Brettell Lane, Brierley Hill, Bilston, Bradley, Compton, Cradley Heath, Darlaston, Deepfields, Finchfield, Heath Town, Kingswinford, Lye, Lower Gornal, Old Hill, Ocker Hill, Penn, Princes End, Pensnett, Quarry Bank, Short Heath, Tipton, Tettenhall, Willenhall, Wednesfield, Wordsley, Wednesbury, Stourbridge.	Ocker Hill, Tipton	1902	.. ..	.. ..
14 NEWCASTLE-UPON-TYNE ELECTRIC SUPPLY CO., LTD.	Part of Northumberland (375 sq. miles)	Carville, Dunston and Neptune Bank	1889	R. P. Sloan (Man.), J. S. Watson (Tech. Man.)	Charles H. William McL
15 NORTH METROPOLITAN ELECTRIC POWER SUPPLY CO.	Counties of Middlesex, Hertford & Essex (323 sq. miles); also London (Stoke Newington)	Brimsdown	1904	H. H. Perry (Res.) ..	E. T. Ruthven (Engineer-
		Willesden	1903	F. D. Napier (Res.) ..	
		Hertford	1901	J. M. Bowman (Res.) ..	
		St. Albans	1908	T. E. Eachus (Res.) ..	
16 NORTH WALES POWER & TRACTION CO.	Supplies slate quarries in the neighbourhood of Carnarvon, Blaenau Festiniog, &c.	Cwm-Dyll, Snowdon. (Water power)	1906	G. K. Paton (Elec. Eng.)	.. .. ..
17 NORTH-WESTERN ELECTRICITY & POWER CAS CO.	Parts of Stafford, Derby, Flint and Denbigh	(Stone, Sutton and Ruabon, proposed)	..	.. ..	Lacey & Sillar; H. A. H
18 PRIESTMAN POWER CO., LTD.	Energy sold in bulk to Newcastle-upon-Tyne Electric Supply Co.	Blaydon	1904	.. ..	Merz & McLellan
19 SCOTTISH CENTRAL ELECTRIC POWER CO.	Linlithgow, Clackmannan, parts of Stirling and Dumbarton (400 sq. miles)	Bonnybridge	1905	E. C. Churchward (Gen. Man. and Engineer). H. H. Partington (Chief Asst.)	.. ..
20 SOUTH WALES ELECTRICAL POWER DISTRIBUTION CO.	Glamorganshire and part of Monmouth (1,034 sq. miles)	Treforest (and Cwmbran*)	1904	W. A. Chamen	.. ..
21 YORKSHIRE ELECTRIC POWER CO.	Yorkshire (West Riding) 1,900 sq. miles	Thornhill	1905	W. B. Woodhouse ..	.. ..

ARMORDUCT CABLE I

IDEAL AND

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098,714	Elec. Dept. at 1d. per unit. Data to Mar. 31, 1911	74	169	TAUNTON	Taunton Electric Traction Co. Ltd.	1901	C. W. Durnford	1.66	3ft. 6in.	90	6 s.d.	*	(tr. only
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472,176	*Bulk supply to Gosport & Alverstoke Electric Lighting Co. Data to Sept. 30, 1910	75	170	TORQUAY	Torquay Tramways Co., Ltd.	1907	Harry Holliday	8.41	3ft. 6in.	90	18 d.d.	*	
278,253	*Energy purchased from Gravesend Corporation. Data to Dec. 31, 1910	76	171	TYNEMOUTH & DISTRICT	Tynemouth and District Electric Traction Co., Ltd.	1901	R. Simpson	4.21	3ft. 6in.	90	21 d.d.	*	
..	*Energy purchased from Greenock Corporation ..	77	172	TYNESIDE	Tyneside Tramways & Tramroads Co.	1902	J. C. Little (Sec. & Res. Man.) F. H. Briggs	11	4ft. 8½in.	95	24 d.d.	*	
	Energy purchased from Grimsby Corpn. for lines in Grimsby	78	173	WAKEFIELD & DISTRICT	Wakefield & District Light Railway Co.	1904	H. England C. J. Jewell	24.69	4ft. 8½in.	96	67 d.d.	1,600	1,431
864,310	Refuse destructor takes entire load when refuse available. Data to Dec. 31, 1910	79	174	WALLASEY	Wallasey Corporation	1902	R. R. Greene J. A. Crowther	8.72	4ft. 8½in.	98	50 d.d.	1,100*	825
957,212	*Lighting and traction station; tramways supplied at 1¼d. per unit. Data to Mar. 31, 1911	80	175	WALSALL	Walsall Corporation	1904	R. L. Horsfield A. S. Barnard	13.5	3ft. 6in.	90 & 92	32 d.d.	1,730*	1,026
291,571	Data to Dec., 1910	81	176	WALTHAMSTOW	Walthamstow Urban District Council	1905	Wm. Murray G. R. Spurr	9	4ft. 8½in.	100	32 d.d.	*	
188,643	*Cars belong Accrington & Rawtenstall Corpn. †Energy purchd. from Accrington Corpn. Data to Mar. 31, 1911	82	177	WALTON-ON-THE-NAZE PIER	Coast Development Corporation, Ltd.	1898	T. Faiers E. A. Lambert	0.5	3ft. 6in.	36	1 motor car, 2 trailers	..	..
52,210	Two rotary-converter sub-stations. *2 route miles on Dolter surface-contact system. Data to Dec. 31, 1910	83	178	WARRINGTON	Warrington Corporation	1902	J. Telfer F. V. L. Mathias	6.5	4ft. 8½in.	90	21 d.d.	2,150*	1,301
..	Pier Electric Railway. Third rail, angle bar beneath deck. Gas power. Data to April 28, 1911	84	179	WEMYSS & DISTRICT	Wemyss and District Tramways Co., Ltd.	1906	Major W. T. J. Marshall R. Richardson	7.5	3ft. 6in.	95 & 97	17 s.d.	690	300
84,396	*Rolling stock supplied by Bury & Rochdale; energy by Heywood. †Lg. and tr. station. Data to Mar. 31, 1911	85	180	WEST BROMWICH	South Staffordshire (Lessee Co.)	1902	W. G. Bond W. A. Jackson	7	3ft. 6in.	97½	30 d.d.	1,550*	742
01,660	Data to March 31, 1911	86	181	WEST HAM	West Ham Corporation	1904	H. E. Blain	15.5	4ft. 8½in.	100	118 d.d., 2 water cars	11,400*	(tr. only
48,671	*6 motor-buses. Data to March 31, 1911	87	182	WEST MIDDLESEX, THAMES VALLEY & WIMBLEDON	London United Tramways, Ltd.	1901	A. H. Stanley	55.5	4ft. 8½in.	92½ & 100	340 d.d.	3,500	
74,398	*Lighting and traction station. Data to Mar. 31, 1910	88	183	WESTON-SUPER-MARE	Weston-super-Mare and District Electric Supply Co., Ltd.	1902	G. Charlton G. Charlton	2.92	4ft. 8½in.	90	8 d.d., 4 s.d.	1,100*	369
35,454	*Energy purchased from Derbyshire and Notts. Electric Power Co. Data to March 31, 1911	89	184	WIGAN	Wigan Corporation	1901	James Slevin James Slevin	24.87	3ft. 6in. & 4ft. 8½in.	105	13 d.d., 54 s.d.	1,140*	
40,242	*Lighting and traction station. Data to Mar. 31, 1911	90	185	WOLVERHAMPTON	Wolverhampton Corporation	1902	W. A. Luntley (Gen. Man.) C. Shawfield(Cons.) H. Vickers(El. Eng.)	13.5	3ft. 6in.	91 & 96	34 d.d., 4 s.d. 11 comb.	2,900* (tr. only)	1,300
			186	WOLVERHAMPTON DISTRICT	Wolverhampton District Electric Tramways, Ltd.	1900	W. G. Bond (Gen. Man.)	14.70	3ft. 6in.	94	32 d.d.	*	
33,104	Data to Sept. 30, 1910	91	187	WORCESTER	Worcester Electric Traction Co.	1904	J. R. Groves	5.86	3ft. 6in.	94	15 d.d.	*	
96,088	Open in summer only. Data to October 31, 1910		188	WREXHAM	Wrexham and District Electric Tramways, Ltd.	1903	A. A. Hawkins	4.44	3ft. 6in.	97	10 d.d.	*	
31,506	*Lighting and traction station. Data to Sept. 30, 1910	92	189	YARMOUTH	Yarmouth Corporation	1902	F. L. Turner G. Bryant	10.5	3ft. 6in.	90	35 d.d.	400*	..
92,795	*Energy purchased from County of Durham E.P.D. Co. and South Shields Corp. Data to Dec. 31, 1910	93	190	YORK	York Corporation	1910	J. W. Hame J. W. Hame	5.87	3ft. 6in.	100	22 d.d.	1,980	1,000
9,387 months) 1,258	*Lighting and traction; 200 KW. for traction. Year ends Mar. 31, 1909	94	191	YORKSHIRE (WOOLLEN DISTRICT)*	Yorkshire (W. D.) Electric Tramways, Ltd.	1903	E. A. Paris (Man. Dir.)	22.25	4ft. 8½in.	94	50 d.d., 16 s.d. 3 regen.	*	about 1,600
	*Energy purchased from Kidderminster & Dist. Elec. Lighting & Traction Co., Ltd.	95											

ELECTRIC RAILWAYS.

Average Distance between Stations, Miles.	Average Schedule Speed, miles per hour.	Weight of Rails per Yard. Running.	Weight of Rails per Yard. Conductor.	No. of Motor Cars.	No. of Trailers.	Power Station Capacity, Kilowatts.	Maximum Load Recorded, Kilowatts.	Maximum Output of Battery.	System of Generation.	Line Equipment.	Line Pressure.	Capital Outlaid.	Annual Train Mileage.	Passengers carried per Annum.	Ratio of Expenses to Receipts.	
0.5	15	100 lb.	85 lb.	64	172	7,600	..	..	5,000 v., 25~, 3-ph.	3rd rail	550 volts D.C.	..	1,507,396 (1910)	40,660,856 (1910)	56.11% (1910)	Separate tunnels. F day 1¾-minute
0.523	14.3	60 lb. & 80 lb.	40 lb.	52 locos. 165 coaches	3,850	2,600	..		500, 1,000 & 2,000 v. D.C.	3rd rail	500 volts D.C.	£3,149,772	1,423,115	25,129,651	46.65%	First electric railway
1.684	16.24	85 lb.	80 lb.	32	44	3,440	2,120	..	550 v. D.C.	3rd and 4th rails	550 v. D.C.	£2,010,000 authorised	675,691	11,822,943	53.03%	Separate tunnels. T
0.511	16	97½ lb.	102 lb.	40*	80*	6,000	3,500	1,500 KW.	6,500 v., 50~, 3-ph.	3rd and 4th rails	600 volts D.C.	..	..	..	..	Three motor-generat stations and goods 2 motors + 4 trailers
1.135	30	86 lb.	70 lb.	50 4-motor, 12 2-motor	52	9,750	6,000 for 1 hour	5 bats. 6,200 A.H. total	7,500 v., 25~, 3-ph.	3rd rail & uninsulated return*	600 v. D.C.	..	1,513,000	..	..	*Third rail outside converter substati motors per coach.
0.4	..	60 lb.	..	44	7	2,300	..	650 KW.	500—550 v. D.C.	3rd rail	500 volts D.C.	..	849,706	8,130,271	66.56%	The Railway Co. e substation at 1,10
1.08	23.5	94 lb.	Overhead	30	56	*	..	..	6,700 v., 1-ph.	Overhead conductor, rail return	6,600 volts A.C.	..	..	..	..	Single-phase A.C. mot Supply Corporation
1.47	16.82	90 lb.	85 lb.	168	308	44,000	..	..	11,000 v., 33⅓~, 3-ph.	3rd and 4th rail's	600 volts D.C.	£16,303,112	5,703,066	93,710,419	46.517*	Controlled by the U *Including rates an
1.925	..	86 lb.	100 lb. 60 lb.	24	37	4,650	4,550	650 KW.	650 v. D.C.	3rd and 4th rails	600 volts D.C.	£3,599,270 (inclusive)	662,744	14,806,000	58.08%	Tunnel railway under
1.65	17.05	87 lb.	100 lb.	161	198	44,000†	†	†	11,000 v., 33⅓~, 3-ph.	3rd and 4th rails	600 volts D.C.	£12,452,885	3,390,251	72,732,612	48.92	Converted from steam running powers ove
1.71	22	86 lb.	130 lb.	110, and 20 locos.	200	20,500	12,000	..	11,000 v., 33⅓~, 3-ph.	3rd and 4th rails	600 volts D.C.	£15,192,774	3,735,263 partly steam	102,849,458	49.60%	Turbine power statio Total mileage work
3	30 and 22*	85 lb.	Overhead	3	6	700	1,012	350 KW. for 1 hour	Gas driven D.C. gen. and D.C. A.C. motor gen. 6,600 v. 25~, 1-ph.	Overhead conductor, rail return	6,600 volts, 1-ph. A.C.	..	86,782	..	..	Single-phase A.C. mo exclusive of stops.
1.25	22	90 lb.	80 lb.	62	44	†	..	..	6,000 v., 40~, 3-ph.	3rd rail	600 v. D.C.	..	(1910) 1,208,776; car-mls. 3,820,558	..	..	Rotary-converter subs lines electrified to p
1.5	18	87 lb.	46 lb.	17	12	1,200	600	..	510—530 v. D.C.	3rd rail	500 volts D.C.	£600,000*	190,000*	5,500,000*	45%*	Separate tunnels. Th

ELECTRIC POWER COMPANIES.

Consulting Engineers.	Power Station capacity, Kilowatts.	Maximum load recorded, Kilowatts.	System of Generation.	System of Distribution.	Total Connections of all kinds.	Capital Expended.	Price Charged per unit.	System of Charging.	U
Charles H. Merz and William McLellan	6,000	Tees District 9,050 Bp. Auckland District 3,554	11,500 v., 40~, 3-ph.	Three-phase—Underground and Overhead	30,000 KW.	£1,000,000 authorised	Power and heating 2½d. to 1½d., and special terms	Max. demand and flat rate with discounts	
Main & Robertson	17,600	8,500	11,000 v., 25~, 3-ph.	400 v. 3-ph., 230 v. single phase	29,000 KW.	£702,389	3.5 to 0.75d.	Max. demand	
Mumdson's Electricity Corporation, Ltd.	1,500 K.W.		10,000 volts, 3-phase	Overhead; wood and steel poles		£450,000 authorised			
Charles H. Merz and William McLellan.			5,750 v., 40~, 3-ph.	Transmission up to 20,000 volts, Cables and Overhead Lines. Supplied direct or transmitted to Substations and thence transformed to L. T. 440 v. Tr. 500 volts.	30,350 KW.	£265,120	Bulk supply only, to the County of Durham Electrical Power Distribution Co., Ltd.		
	1,500	710	11,000 v., 25~, 3-ph., and 500-550 v. D.C.	2,200 v., & 440 v., 3-ph.; 500-550 D.C.	2,550 KW.		1.375 to 0.4d.	Max. demand & sliding scale	
See "Remarks"	11,000	4,927	5,750 v., 40~, 3-ph.	3-core underground cables and overhead lines	9,250 KW.	£155,000 authorised			
	2,100*		3,000 v., 50~, 2-phase. 6,000 v., 50~, 3-phase	3,000 v. 2-ph. and 6,000 v. 3-ph. underground and overhead. 440 & 220 v., 2 & 3-ph., underground		£600,000 authorised			
L. Addenbrooke						£250,000 authorised			
	3,500	900	11,000 v., 50~, 3-ph.	400 & 230 v., 3-ph. 100 & 230 v., single ph.	2,472 KW.	£750,000 authorised	Lighting 5½d. with increasing discounts. Power 1.66 to 0.52d. & by contract.	Sliding scale according to load.	
F. Parshall	8,000	4,600	10,000 volts, 50~, 3-ph.	Various	11,000 H.P.	£380,915	From .4 to 4d., depending on load factor	Various	
						£750,000 authorised			
	17,250	9,537	2-ph., 60~, 10,000 v., and Series Direct Current	A.C. 60~, 100 & 200 v. (single-phase), D.C. at 200v., three-phase 4-wire at 240 and 415v.	26,715 KW.	£1,936,530	Private lighting 6d. Trade do. 5d. to 3d. (sliding scale). Power 3d. & ½d. (M.D.)	Flat rate. Contract Tariff, fixed charge per ann. plus 2d. per unit up to the amount of the fixed charge; additional units 1d. For Power: fixed charge plus 1d. with discounts to ½d. per unit.	
	7,600	5,702	7,000 v., 50~, 2-ph.	200 v. per phase	9,632 KW	£456,313	Lighting 4d., with various discounts; pr. 1½d., with various discounts	Max. demand & flat rate	
Charles H. Merz and William McLellan	70,000	46,000	5,750 v., 40~, 3-ph.	Transmission 20,000 volts and 5,500 volts. Three-phase, 440 volts; D.C., traction 500 and 600 volts, lighting, etc., 480 and 240 volts	107,000 KW.	£2,062,500	Lg. 3¾d.; pb. lg. £2 17s. 6d. per 16-C.P. p.a.; pr. 1½d. with discounts	Flat rate and max. demand	
	5,000	3,605	50~, 3-ph., at 10,000 v.	In bulk, D.C. three-wire, and 3-ph.	10,000 KW.	£548,300	25/- to 20/- per KW. of max. dem. per quarter, & 1d. to 0.25d. per unit metered	Contract on max. demand & flat rate	
T. Ruthven-Murray (Engineer-in-Chief)	5,850	4,370	50~, 3-ph., at 10,000 and 2,950 v.; and direct current at 240, 480 and 550 v.	Also under Tottenham, Edmonton, Kingsbury and Southgate E.L. Orders. 3-ph. 4-wire					
	300	185	230 and 460 v. D.C.	Direct	525 KW.				
	490	330	230 and 460 v. D.C.	Direct	700 KW.				
	4,000		10,000 volts, 50~, 3-ph.	Overhead transmission lines 10,000 and 20,000 volts, 3-phase	3,050 B.H.P.		Approx. av. 1d., sliding scale	Various	
Ry & Sillar: H. A. Humphrey						£1,500,000 authorised			
& McLellan	2,800	2,740	5,750 v., 40~, 3-phase	Sold in bulk, H.T.					
	3,000	1,200	3,000 v., 50~, 2 & 3-ph., and 6,000 v., 50~, 3-ph.	3,000 v., 50~, transformed to 440 v., 50~, 2 and 3-ph.; and 6,000 v., 50~, transformed to 440 v., 50~, 3-ph., at consumer's premises		£600,000 authorised	Power 1.25 to 0.75d.; traction, contract	Maximum demand, sliding scale, 2-rate meter and contract	
	T. 10,500 C. 1,900	5,000	11,000 v., 25~, 3-ph.	2,200, 440 & 230 v., 25~, 3 & 1-ph.	12,640 H.P.		4½d. to 0.35d.	Sliding scale & flat rate	
	10,000		10,000 v., 50~, 3-ph.	2,000 and 400 v., 3-ph.; 230 v. 1-ph.; 500 v. D.C.		£398,000	Terms on application	Max. demand	

IN ARMORDUCT CONDUI

RELIABLE COMBINATION.

ill, London.

													Elec. Dept. at 1d. per unit. Data to Mar. 31, 1911	74
6.5	4ft. 8½in.	87	16 d.d., 2 s.d.	*	..	..	£98,646	*	301,389	2,472,176	*Bulk supply to Gosport & Alverstoke Electric Lighting Co. Data to Sept. 30, 1910		75
7.42	4ft. 7¾in.	92	40 (1 demi-car)	*	..	..	£237,771	*	784,647	7,278,253	* Energy purchased from Gravesend Corporation. Data to Dec. 31, 1910		76
6	4ft. 8½in.	90	32 d.d. ..	300	..	..	..	..	..	..	* Energy purchased from Greenock Corporation ..		77
3.5	4ft. 8½in.	40, 74 & 84	9 d.d., 1 s.d., 8 trailers	130	100	..	£27,632	..	Car 142,794 Tlrs.24,072	864,310	Energy purchased from Grimsby Corpn. for lines in Grimsby Refuse destructor takes entire load when refuse available. Data to Dec. 31, 1910		78 79
37.4	3ft. 6in.	35.5	93 d.d., 2 s.d.	4,750*	2,960	660 KW.	£399,269	£259,313*	1,894,262	16,957,212	*Lighting and traction station; tramways supplied at 1¼d. per unit. Data to Mar. 31, 1911		80
6.72	3ft. 6in.	90	21 d.d. ..	400	360	..	£94,515		427,790	2,391,571	Data to Dec., 1910		81
3	4ft. 0in.	100	*	†	..	100 KW.	£25,000*	£1,387† (sub. stn.)	149,612	1,188,643	*Cars belong Accrington & Rawtenstall Corpn. †Energy purchd. from Accrington Corpn. Data to Mar. 31, 1911		82
19.3*	3ft. 6in.	90	65 d.d. ..	2,100	..	82 KW.	£488,300		1,402,000	8,652,210	Two rotary-converter sub-stations. *2 route miles on Dolter surface-contact system. Data to Dec. 31, 1910		83
0.75	3ft. 0in.	60	3 s.d. ..	50	..	..	..	..	..	..	Pier Electric Railway. Third rail, angle bar beneath deck. Gas power. Data to April 28, 1911		84
4.25	4ft. 8½in.	90	*	900†	300	..	£28,762	£6,496†	275,063	2,084,396	*Rolling stock supplied by Bury & Rochdale; energy by Heywood. †Lg. and tr. station. Data to Mar. 31, 1911		85
28.5	4ft. 7¾in.	98 & 105	76 d.d. ..	2,200	1,870	..	£357,557	£50,769	2,058,663	19,001,660	Data to March 31, 1911		86
16	4ft. 8½in.	94	136 d.d* ..	2,100	1,484	..	£481,933		3,695,281	37,948,671	*6 motor-buses. Data to March 31, 1911		87
6.62	4ft. 8½in.	100	26 d.d. (6 bogie cars)	*	..	..	£148,170	*	666,364	7,274,398	*Lighting and traction station. Data to Mar. 31, 1910		88
3.8	3ft. 6in.	90	13 d.d. ..	1,000*	600	..	£47,745	*	254,035	1,765,454	* Energy purchased from Derbyshire and Notts. Electric Power Co. Data to March 31, 1911		89
10.8	3ft. 6in.	90	36 d.d. ..	*	..	..	£114,470	*	676,255	5,240,342	* Lighting and traction station. Data to Mar. 31, 1911		90
18	3ft. 0in.	56 & 62½	39 mr., 18 tr. (s.d. comb.)	1,300	1,337	347 KW.	..	..	360,083 (train miles)	533,104	Data to Sept. 30, 1910		91
4.5	3ft. 6in.	36	2 automob.										
3.5	4ft. 8½in.	65	8 d.d. ..	200	..	..	£41,445	..	36,385	196,088	Open in summer only. Data to October 31, 1910 ..		
11·5	3ft. 6in.	90	59 d.d. ..	1,500*	1,200 (inc. lg.)	60 KW.	..	*	720,350	4,581,506	* Lighting and traction station. Data to Sept. 30, 1910		92
2.54	4ft. 8½in.	95	10 d.d. ..	*	..	..	£68,781	*	168,840	1,222,795	*Energy purchased from County of Durham E.P.D. Co. and South Shields Corp. Data to Dec. 31, 1910		93
3.27	4ft. 0in.	95	12 d.d., 2 motor buses	200*	160	..	£46,000	£42,000*	167,915 (9 months)	1,429,387 (9 months)	*Lighting and traction; 200 KW. for traction. Year ends Mar. 31, 1909		94
4.6	3ft. 6in.	75	4 d.d., 9 s.d.	*	..	..	£60,851	*	177,491	671,258	*Energy purchased from Kidderminster & Dist. Elec. Lighting & Traction Co., Ltd.		95

169	TAUNTON	Taunton Electric Ltd.
170	TORQUAY	Torquay Tramways
171	TYNEMOUTH & DISTRICT	Tynemouth and Di Traction Co., Ltd
172	TYNESIDE	Tyneside Tramway Co.
173	WAKEFIELD & DISTRICT	Wakefield & Distric way Co.
174	WALLASEY	Wallasey Corporati
175	WALSALL	Walsall Corporation
176	WALTHAMSTOW	Walthamstow Urb Council
177	WALTON-ON-THE-NAZE PIER	Coast Development Ltd.
178	WARRINGTON	Warrington Corpora
179	WEMYSS & DISTRICT ..	Wemyss and Distri Co., Ltd.
180	WEST BROMWICH	South Staffordshire
181	WEST HAM	West Ham Corporat
182	WEST MIDDLESEX, THAMES VALLEY & WIMBLEDON	London United Tra
183	WESTON-SUPER-MARE ..	Weston-super-Mare Electric Supply Co
184	WIGAN	Wigan Corporation
185	WOLVERHAMPTON	Wolverhampton Cor
186	WOLVERHAMPTON DISTRICT	Wolverhampton Dis Tramways, Ltd.
187	WORCESTER	Worcester Electric T
188	WREXHAM	Wrexham and Dist Tramways, Ltd.
189	YARMOUTH	Yarmouth Corporati
190	YORK	York Corporation ..
191	YORKSHIRE (WOOLLEN DISTRICT)*	Yorkshire (W. D.) E ways, Ltd.

ELECTRIC RAILWA

	Year of Opening.	Manager.	Electrical Engineer.	Consulting Engineers.	Length of Route in Miles.	Average distance between Stations, miles.	Average Schedule Speed, miles per hour.	Weight of Rails per Yard. Running.	Weight of Rails per Yard. Conductor.	No. of Motor Cars.	No. of Trailers.	Power Station Capacity, Kilowatts.	Maximum Load Recorded, Kilowatts.	Maximum Output of Battery.	System of Generation.	Li
on	1900	H. F. Parshall .. .. (Chairman)	E.P. Grove (Chief Eng.)	Basil Mott	7 7.36 authorised	0.5	15	100 lb.	85 lb.	64	172	7,600	..	..	5,000 v., 25~, 3-ph.	3rd rail
on	1899	T. C. Jenkin	P. V. McMahon ..	Basil Mott & David Hay	7.33	0.523	14.3	60 lb. & 80 lb.	40 lb.	52 locos.	165 coaches	3,850	2,600	..	500, 1,000 & 2,000 v. D.C. ..	3rd rail
..	1904	R. P. Brousson ..	R. P. Brousson ..	Sir Douglas Fox & Partners	3.42	0.684	16.24	85 lb.	80 lb.	32	44	3,440	2,120	..	550 v. D.C.	3rd and 4
..	1906	J. C. Inglis	Roger T. Smith (G.W.R.)	Kennedy & Jenkin ..	4.71	0.511	16	97½ lb.	102 lb.	40*	80*	6,000	3,500	1,500 KW.	6,500 v., 50~, 3-ph.	3rd and 4
ra	1904 (converted)	John A. F. Aspinall .. (Gen. Man.)	Geo. Hughes (Chief Mech. Eng.)	.. ..	40	1.135	30	86 lb.	70 lb.	504-motor, 12 2-motor	52	9,750	6,000 for 1 hour	5 bats. 6,200 A.H. total	7,500 v., 25~, 3-ph.	3rd rail &
..	1893	E. J. Neachell	E. J. Neachell	.. ..	6.5	0.4	..	60 lb.	..	44	7	2,300	..	650 KW.	500—550 v. D.C.	3rd rail
..	1909 (Dec.) (converted) 1911 (May) (converted)	William Forbes (Gen. Man.)	R. H. Houghton ..	Philip Dawson	8.7	1.08	23.5	94 lb.	Overhead	30	56	*	..	..	6,700 v., 1-ph.	Overhead
..	1906 & 1907	A. H. Stanley	.. ..	.. ..	22.213	0.47	16.82	90 lb.	85 lb.	168	308	44,000	..	..	11,000 v., 33⅓~, 3-ph. ..	3rd and 4
..	1903 (converted)	J. Shaw (Gen. Man.)	J. Shaw	.. ..	4.77	0.925	..	86 lb.	100 lb. 60 lb.	24	37	4,650	4,550	650 KW.	650 v. D.C.	3rd and 4
..	1905 (converted)	A. H. Stanley	.. ..	.. ..	24.3*	0.65	17.05	87 lb.	100 lb.	161	198	44,000†	†	†	11,000 v., 33⅓~, 3-ph. ..	3rd and 4
..	1905 (converted)	R. H. Selbie (Gen. Man.)	Charles Jones	.. ..	26	0.71	22	86 lb.	100 lb.	110, and 20 locos.	200	20,500	12,000	..	11,000 v., 33⅓~, 3-ph.	3rd and 4
..	1908 (converted)	W. G. Granet (Gen. Man.)	W. B. Worthington (Chief Eng.) Henry Fowler (Chief Mech. Eng.)	.. ..	9.5	3	30 and 22*	85 lb.	Overhead	3	6	700	1,012	350 KW. for 1 hour	Gas driven D.C. gen. and D.C. A.C. motor gen. 6,600 v. 25~, 1-ph.	Overhead return
..	1904 (converted)	A. Kaye Butterworth (Gen. Man.)	W. Worsdell (R. S.), C. A. Harrison (P.W.)	Merz and McLellan ..	35*	1.25	22	90 lb.	80 lb.	62	44	†	..	..	6,000 v., 40~, 3-ph.	3rd rail
..	1898	Sir C. J. Owens (Gen. Man.)	Herbert Jones, M.I.E.E.	.. ..	1.5	1.5	18	87 lb.	46 lb.	17	12	1,200	600	..	510—530 v. D.C.	3rd rail

ELECTRIC POWER CO

	Generating Stations.	Year of Opening.	Engineer and Manager.	Consulting Engineers.	Power Station capacity, Kilowatts.	Maximum load recorded, Kilowatts.	System of Generation.	System of Distr
nty (843 sq. miles) ..	Grangetown	1904	A. B. Gridley (Man.) ..	Charles H. Merz and William McLellan	6,000	Tees District 9,050 Bp. Auckland District 3,554	11,500 v., 40~, 3-ph.	Three-phase—Underground and
(759 sq. miles) ..	Yoker and Motherwell	1905	David A. Starr	Strain & Robertson ..	17,600	8,500	11,000 v., 25~, 3-ph.	400 v. 3-ph., 230 v. single phase
.. ..	Hayle. (St. Blazey and Phillack, proposed) ..	1911	L. A. Hards	Edmundson's Electricity Corporation, Ltd.	1,500 K.W.	.. .. ..	10,000 volts, 3-phase	Overhead; wood and steel pole
.. ..	Energy supplied in bulk by Newcastle-upon-Tyne Electric Supply Co.	1902	.. ..	Charles H. Merz and William McLellan.	.. .. ..	.. .. ..	5,750 v., 40~, 3-ph.	Transmission up to 20,000 volts Lines. Supplied direct or tra and thence transformed to L.
rby (1,570 sq. miles)..	Ilkeston (Newark and Sutton-in-Ashfield, proposed)	1903	A. E. Loos (Gen. Man.)..	.. ..	1,500	710	11,000 v., 25~, 3-ph., and 500-550 v. D.C....	2,200 v., & 440 v., 3-ph.; 500-55
.. ..	Philadelphia	1906	W. S. Verrill (Res.) ..	†See "Remarks" ..	11,000	4,927	5,750 v., 40~, 3-ph.	3-core underground cables and
.. ..	Townhill	1905	J. S. Thomson (Gen. Man.)	.. ..	2,100*	.. .. ..	3,000 v., 50~, 2-phase. 6,000 v., 50~, 3-phase.. ..	3,000 v. 2-ph. and 6,000 v. 3-ph. head. 440 & 220 v., 2 & 3-ph.,
.. ..	Stroud and West Dean	..	.. ..	G. L. Addenbrooke ..	.. ..	.. .. ..	.. ..	.. ..
West Kent Electric	Frindsbury	1907	H. B. Harvey (Man. and Engineer)	.. ..	3,500	930	11,000 v., 50~, 3-ph.	400 & 230 v., 3-ph. 100 & 230 v
r, Salford, Stockport,	Radcliffe	1905	C. D. Taite	H. F. Parshall	8,000	4,600	10,000 volts, 50~, 3-ph.	Various .. ..
.. ..	(Newbold-on-Avon, Whitacre, Hinkley, Glenfield and Measham, proposed)	..	.. ..	.. ..	.. .. ..	.. .. ..	.. ..	.. ..
l, Southall-Norwood Acton and Uxbridge, mpstead & Fulham; Twickenham, Tedgh, Eton, Wycombe denhead, Kingsbury,	Willesden: Amberley Road..	..	J. S. Highfield	.. ..	17,250	9,537	2-ph., 60~, 10,000 v., and Series Direct Current ..	A.C. 60~, 100 & 200 v. (single three-phase 4-wire at 240 and
Bradley, Compton, Heath Town, Kingswinford, Penn, Princes End, ttenhall, Willenhall,	Ocker Hill, Tipton	1902	.. ..	.. ..	7,000	5,702	7,000 v., 50~, 2-ph.	200 v. per phase .. ..
.. ..	Carville, Dunston and Neptune Bank	1889	R. P. Sloan (Man.), J. S. Watson (Tech. Man.)	Charles H. Merz and William McLellan	70,000	46,000	5,750 v., 40~, 3-ph.	Transmission 20,000 volts and phase, 440 volts; D.C., tract lighting, etc., 480 and 240 volt
	Brimsdown	1904	H. H. Perry (Res.) ..		5,000	3,605	50~, 3-ph., at 10,000 v.	In bulk, D.C. three-wire, and 3-
iles); also London	Willesden	1903	F. D. Napier (Res.) ..	E. T. Ruthven-Murray (Engineer-in-Chief)	5,850	4,370	50~, 3-ph., at 10,000 and 2,050 v.; and direct current at 240, 480 and 550 v.	Also under Tottenham, Edm Southgate E.L. Orders. 3-p
	Hertford	1901	J. M. Bowman (Res.) ..		300	185	230 and 460 v. D.C.	Direct .. ..
	St. Albans	1908	T. E. Eachus (Res.) ..		490	330	230 and 460 v. D.C.	Direct .. ..
arnarvon, Blaenau	Cwm-Dyli. Snowdon. (Water power)	1906	G. K. Paton (Elec. Eng.)	.. ..	4,000	.. .. ..	10,000 volts, 50~, 3-ph.	Overhead transmission lines 1 3-phase
.. .. ..	(Stone, Sutton and Ruabon, proposed)	..	.. ..	Lacey & Sillar; H. A. Humphrey	.. ..	.. .. ..	.. ..	.. ..
Supply Co.	Blaydon	1904	.. ..	Merz & McLellan ..	2,800	2,740	5,750 v., 40~, 3-phase	Sold in bulk, H.T. .. ..
arton (400 sq. miles)	Bonnybridge	1905	E. C. Churchward (Gen. Man. and Engineer). H. H. Partington (Chief Asst.)	.. ..	3,000	1,200	3,000 v., 50~, 2 & 3-ph., and 6,000 v., 50~, 3-ph. ..	3,000 v., 50~, transformed to 44 and 6,000 v., 50~, transforme at consumer's premises
.. .. ..	Treforest (and Cwmbran*)	1904	W. A. Chamen	.. ..	T. 10,500 C. 1,900	5,000	11,000 v., 25~, 3-ph.	2,200, 440 & 230 v., 25~, 3 & 1-p
.. .. ..	Thornhill	1905	W. B. Woodhouse ..	.. ..	10,000	.. .. ..	10,000 v., 50~, 3-ph.	2,000 and 400 v., 3-ph.; 230 v. 1

CABLE IN ARMORDU

DEAL AND RELIABLE C

shed by the proprietors, H. ALABASTER, GATEHOUSE & Co., 4, Ludgate Hill, London.

n Electric Traction Co.	1901	C. W. Durnford		1.66	3ft. 6in.	90	6 s.d. ..	*	(tr. only) ..	..	£30,651	*	109,709	518,554	*Lighting and traction station. Energy purchased from Elec. Department. Data to March 31, 1911	168
y Tramways Co., Ltd. ..	1907	Harry Holliday		8.41	3ft. 6in.	90	18 d.d. ..	*	..	..	..	*	382,809.48	2,876,463	*Energy purchased from Taunton Corporation. Data to Dec. 31, 1909	169
outh and District Electric ion Co., Ltd.	1901	R. Simpson		4.21	3ft. 6in.	90	21 d.d. ..	*	..	..	£97,915	*	282,030	2,056,390	*Energy purchased from Torquay Corporation. Data to Dec. 31, 1910.	170
e Tramways & Tramroads	1902	J. C. Little .. (Sec. & Res. Man.)	F. H. Briggs ..	11	4ft. 8½in.	95	24 d.d. ..	*	..	..	£207,489	*	697,218	4,475,721	*Energy purchased from Tynemouth Corporation. Data to Dec. 31, 1910	171
ld & District Light Rail-o.	1904	H. England ..	C. J. Jewell ..	24.69	4ft. 8½in.	96	67 d.d. ..	1,000	1,481	100 KW.	£701,761	£52,901	1,770,028	9,220,853	*Energy supplied by Newcastle-upon-Tyne Elec. Supply Co., Ltd., & Tynemouth Corp. Data to Dec. 31, 1910 Data to Dec. 31, 1910	172
y Corporation	1902	R. R. Greene ..	J. A. Crowther ..	8.72	4ft. 8½in.	98	50 d.d. ..	1,100*	825	440 KW.	£176,159	£108,000	945,948	9,387,665	*Lighting and traction station. Data to Mar. 31, 1910..	174
Corporation	1904	R. L. Horsfield..	A. S. Barnard ..	13.5	3ft. 6in.	90 & 92	32 d.d. ..	1,730*	1,026	..	£165,086	£17,000*	655,921	5,184,620	*Lighting and traction station. Energy purchased from Walsall Corporation. Data to Dec. 31, 1910	175
astow Urban District il	1905	Wm. Murray ..	G. R. Spurr ..	9	4ft. 8½in.	100	32 d.d. ..	*	..	..	£180,000	*	879,756	10,641,127	*Lighting and traction station; gas power. Data to Mar. 31, 1910	176
evelopment Corporation,	1898	T. Faiers ..	E. A. Lambert ..	0.5	3ft. 6in.	36	1 motor car, 2 trailers	..	..	..	..	..	..	..	Third-rail pier electric railway. Energy purchased from Walton Elec. Supply Co.	177
ton Corporation	1902	J. Telfer ..	F. V. L. Mathias	6.5	4ft. 8½in.	90	21 d.d. ..	2,150*	1,301	800 A.H.	£102,146	£95,200*	436,654	5,071,154	*Lighting and traction station. Data to Mar. 31, 1911..	178
and District Tramways d. affordshire (Lessee Co.)	1906	Major W. T. J. Marshall	R. Richardson ..	7.5	3ft. 6in.	95 & 97	17 s.d. ..	690	300	..	£78,000	*	350,473	1,860,000	*Energy purchased from Wemyss Coal Co., Ltd. Data to Dec. 31, 1910	179
	1902	W. G. Bond ..	W. A. Jackson..	7	3ft. 6in.	97½	30 d.d. ..	1,550*	742 (tr. only)	150 KW.	£147,758	£65,315*	†	†	*Lighting and traction station. †See South Staffordshire Tramways. Data to March 31, 1911	180
m Corporation	1904	H. E. Blain		15.5	4ft. 8½in.	100	118 d.d., 2 water cars	11,400*	..	..	£516,500	..	2,908,000 (1909-10)	36,846,649 (1909-10)	*Lighting and traction station; energy supplied at 0.95d. per unit. Data to Mar. 31, 1910	181
United Tramways, Ltd.	1901	A. H. Stanley		55.5	4ft. 8½in.	92½ & 100	340 d.d. ..	3,500	..	..	..	..	8,614,982*	59,255,919	6 converter sub-stns.; 4 fed from L.U.T. stn., 2 from Lot's Rd. *Also 137,770 horse tr. Data to Dec. 31, 1908	182
uper-Mare and District e Supply Co., Ltd.	1902	G. Charlton ..	G. Charlton ..	2.92	4ft. 8½in.	90	8 d.d., 4 s.d.	1,100*	389	576 A.	£127,015 in c.		131,626	1,103,002	*Lighting and traction station. Data to Dec., 1909 ..	183
orporation	1901	James Slevin ..	James Slevin ..	24.87	3ft. 6in. & 4ft. 8½in.	105	13 d.d., 54 s.d.	1,140*	..	750 A.H.	£515,826	*	1,404,639	11,867,950	*Lighting and traction station. Data for 1907-8 ..	184
ampton Corporation ..	1902	W. A. Luntley .. (Gen. Man.)	C. Shawfield(Cons.) H. Vickers(El. Eng.)	13.5	3ft. 6in.	91 & 96	34 d.d., 4 s.d. 11 comb.	2,900* (tr. only)	1,300	750 A.H.	£246,660	*	1,126,607	10,648,802	*Lighting and traction station. Energy from Elec. Com. Lorain surface-contact system. Data to Mar. 31, 1911	185
ampton District Electric ays, Ltd.	1900	W. G. Bond (Gen. Man.)	.. .. ..	14.70	3ft. 6in.	94	32 d.d. ..	*	..	..	£255,494	*	607,901	4,322,888	*Energy purchased from Dudley Corp. and Midland Elec. Corp. for Pr. Distribution. Data to Dec. 31, 1910	186
r Electric Traction Co.	1904	J. R. Groves ..	.. .. ..	5.86	3ft. 6in.	94	15 d.d. ..	*	..	..	£116,625	*	323,668	2,820,164	*Energy purchased from Worcester Corporation. Data for 1910	187
n and District Electric ays, Ltd.	1903	A. A. Hawkins ..	.. .. ..	4.44	3ft. 6in.	97	10 d.d. ..	*	..	..	£57,289	*	143,427	852,770	*Energy purchased from Wrexham Corporation ..	188
h Corporation	1902	F. L. Turner ..	G. Bryant ..	10.5	3ft. 6in.	90	35 d.d. ..	400*	..	200 KW.-hours	..	*	602,823	4,440,183	*Lighting and traction station. Data to Mar. 31, 1911	189
poration	1910	J. W. Hame ..	J. W. Hame ..	5.87	3ft. 6in.	100	22 d.d. ..	1,860	1,060	400 KW.	£127,000	..	458,365	3,864,161	Data to Mar. 31, 1911	190
e (W. D.) Electric Tram-Ltd.	1903	E. A. Paris .. (Man. Dir.)	.. .. ..	22.25	4ft. 8½in.	94	50 d.d., 16 s.d. 3 regen.	†	about 1,600	..	£329,480	†	1,321,918	9,540,988	*Dewsbury, Heckmondwike, Cleckheaton, Liversedge, Gomersal, Birstal, Birkenshaw, Batley, Thornhill, Ravensthorpe. †Energy purchased. Data to Dec.31,1910	191

AYS.

	Line Equipment.	Line Pressure.	Capital Outlaid.	Annual Train Mileage.	Passengers carried per Annum.	Ratio of Expenses to Receipts.	REMARKS.	
	3rd rail	550 volts D.C.	.. ..	1,807,396 (1910)	40,660,856 (1910)	56.11% (1910)	Separate tunnels. Four rotary-converter substations. Multiple-unit control, 7, 6, 5 and 3-car trains, 2-minute service (for small portion of day 1½-minute)	1
	3rd rail	500 volts D.C.	£3,149,772	1,423,115	25,129,651	46.65%	First electric railway constructed. Separate tunnels. Energy transmitted to substations at 1,000 and 2,000 volts D.C.	2
	3rd and 4th rails	550 v. D.C. ..	£2,010,000 authorised	675,691	11,822,943	53.08%	Separate tunnels. Two conductor rails, feeder. Multiple-unit control	3
	3rd and 4th rails	600 volts D.C.	.. ..	.. ..	.. .. ..	..	Three motor-generator substations, two with batteries. Park Royal power station, built by G.W.R., also supplies power and light to stations and goods yards in the London district (2,000 KW. additional provided for this purpose). *Standard trains; 1 motor+2 trailers; 2 motors+4 trailers.	4
	3rd rail & uninsulated return*	600 v. D.C.. ..	.. ..	1,513,000	.. .. ..	..	*Third rail outside track; fourth rail between running rails (no collector on it). Direct and multiple unit control. Four rotary-converter substations, and five batteries. Four-coach trains, 8 150-H.P. motors per train; also multiple-unit coaches, two 125-H.P. motors per coach.	5
	3rd rail	500 volts D.C.	.. ..	849,706	8,130,271	66.56%	The Railway Co. constructed the Seaforth & Gt. Crosby tramways; power transmitted from railway power station to tramway substation at 1,100 v. D.C. Works cost per unit generated, 0.3905d.	6
	Overhead conductor, rail return	6,600 volts A.C.	.. ..	.. ..	.. .. ..	..	Single-phase A.C. motors; direct supply from power station to overhead conductor at 6,600 volts. *Energy purchased from London Electric Supply Corporation	7
	3rd and 4th rail's	600 volts D.C.	£16,303,112	5,703,066	93,710,419	46.517*	Controlled by the Underground Electric Railways Co. of London, Ltd., and energy supplied from that Co's. Chelsea power station. *Including rates and taxes	8
	3rd and 4th rails	600 volts D.C.	£3,599,270 (inclusive)	662,744	14,806,000	58.08%	Tunnel railway under River Mersey, formerly worked by steam (opened 1886). Third rail outside, return rail between running rails ..	9
	3rd and 4th rails	600 volts D.C.	£12,452,885	3,390,231	72,732,612	48.92	Converted from steam. Turbine power station, 11 rotary-converter substations. Multiple-unit control. *Also joint owners of 4 miles, running powers over 27 miles, in addition. †Chelsea Power station, belongs to the Underground Electric Railways Co. of London.	10
	3rd and 4th rails	600 volts D.C.	£15,193,774	3,735,263 partly steam	102,849,458	49.60%	Turbine power station. Third and fourth rails outside and between running rails. Multiple-unit control. Rotary-converter substations. Total mileage worked over, 78 miles (inc. 53½ G. C. Joint, not worked electrically).	11
	Overhead conductor, rail return	6,600 volts, 1-ph. A.C.	.. ..	86,792	.. .. ..	..	Single-phase A.C. motors; no feeders or transformers. *Lancaster-Morecambe, 30 miles p. h.; Morecambe-Heysham, 22 miles p. h. exclusive of stops. Speed restricted to 10 miles p. h. at all three stations.	12
	3rd rail	600 v. D.C. ..	.. ..	(1910) 1,208,776; car-mls. 3,820,558	.. .. ..	..	Rotary-converter substations. Multiple-unit control. 2 locos. for goods, and 3 motor wagons for parcels traffic. *Route miles of running lines electrified to present time. †Power supplied by Newcastle-on-Tyne Electric Supply Co.	13
	3rd rail	500 volts D.C.	£600,000*	190,000*	5,500,000*	45%*	Separate tunnels. Third rail between track rails. Line owned by L. & S.-W. Ry. Co. *Approximate figures	14

OMPANIES.

em of Distribution.	Total Connections of all kinds.	Capital Expended.	Price Charged per unit.	System of Charging.	Units Sold during last complete Year.	Remarks.	
rground and Overhead	30,000 KW.	£1,000,000 authorised	Power and heating 2½d. to 1½d., and special terms	Max. demand and flat rate with discounts	.. .. ..	Bulk supply to Middlesbrough. Address: Hinton's Buildings, Middlesbrough. Sec., P. Greenough. * Supply in bulk is also obtained from the stations of The Waste Heat and Gas Electrical Generating Stations, Ltd., at Newport, Weardale, Teesbridge and elsewhere	1
single phase	29,000 KW.	£702,389	3.5 to 0.75d.	Max. demand	.. .. ..	Yoker started August, 1905, and Motherwell January, 1906. Address: 53, Bothwell St., Glasgow. Sec, Robert Robertson	2
d steel poles	.. .. ..	£450,000 authorised	.. ..	.. ..	.. .. ..	Supply just commenced. Shares in Company now held by the Urban Electric Supply Co., whose generating station is situated at Carn Brea, and supplies the districts of Camborne and Redruth, and surrounding country	3
20,000 volts, Cables and Overhead direct or transmitted to Substations ormed to L. T. 440 v. Tr. 500 volts. ph.; 500-550 D.C.	30,350 KW.	£265,120	Bulk supply only, to the County of Durham Electrical Power Distribution Co., Ltd.	.. ..	.. .. ..	Sec., N. H. Firmin, Royal Exchange Buildings, Newcastle-upon-Tyne. For technical details see Gateshead, Jarrow, etc. (Co. Durham Electrical Power Distribution Co., Ltd.)	4
	2,550 KW.	..	1.375 to 0.4d.	Max. demand & sliding scale	1,616,138	Offices: 53, Temple Chambers, Temple Avenue, London. Sec., G. D. Prince	5
cables and overhead lines	9,250 KW.	£155,000 authorised	.. ..	.. ..	.. .. ..	*Also supplies Sunderland and District Tramways Co. at 0.75d. per unit; Lambton & Hetton Collieries; Houghton & District Electric Lighting Co. †System operated by the Newcastle-upon-Tyne Electric Supply Company, Ltd. Sec., S. W. Hemmin, Basildon House, E.C.	6
000 v. 3-ph. underground and over-, 2 & 3-ph., underground	.. .. ..	£600,000 authorised	.. ..	.. ..	.. .. ..	Statistics not yet available. *An additional 2,000-KW. turbine at present being installed ..	7
.. ..	.. .. ..	£250,000 authorised	.. ..	.. ..	.. .. ..	Supply not commenced. Sec., J. French, 5, Rowcroft, Stroud, Glos.	8
100 & 230 v., single ph.	2,472 KW.	£750,000 authorised	Lighting 5½d. with increasing discounts. Power 1.66 to 0.52d. & by contract.	Sliding scale according to load.	1,792,906	Sec., F. A. H. Walker, Railway Street, Chatham	9
.. ..	11,000 H.P.	£380,915	From .4 to 4d., depending on load factor	Various	10,746,000	Secretary and Offices, T. E. Kay, A.S.A.A., 196, Deansgate, Manchester	10
.. ..	.. .. ..	£750,000 authorised	.. ..	.. ..	.. .. ..	Registered offices: 53, Temple Chambers, Temple Avenue, E.C.	11
0 v. (single-phase), D.C. at 200v., at 240 and 415v.	26,715 KW.	£1,936,530	Private lighting 6d. Trade do. 5d. to 3d. (sliding scale). Power 3d. & ¾d. (M.D.)	Flat rate. Contract Tariff, fixed charge per ann. plus 2d. per unit up to the amount of the fixed charge; additional units 1d. For Power: fixed charge plus 1d. with discounts to ¾d. per unit.	12,287,674	.. ..	12
.. ..	9,632 KW	£456,313	Lighting 4d., with various discounts; pr. 1½d., with various discounts	Max. demand & flat rate ..	8,771,173	Sec., G. Sales, F.C.I.S., 14, Dale Street, Liverpool	13
0 volts and 5,500 volts. Three-D.C., traction 500 and 600 volts, and 240 volts wire, and 3-ph.	107,000 KW.	£2,062,500	Lg. 3¾d.; pb. lg. £2 15s. 6d. per 16-C.P. p.a.; pr. 1½d. with discounts	Flat rate and max. demand ..	.. .. ..	Sec., M. Short, Royal Exchange Bldgs., Newcastle-upon-Tyne	14
hham, Edmonton, Kingsbury and Orders. 3-ph. 4-wire	10,000 KW. 525 KW. 700 KW.	£548,300	25/- to 20/- per KW. of max. dem. per quarter, & 1d. to 0.25d. per unit metered	Contract on max. demand & flat rate	21,422,954	Supply in bulk to Willesden U.D.C., Stoke Newington B.C., Hendon Electric Supply Co., Ltd., North Met. E.P. Distribution Co., Ltd., at Barnet, Enfield, Hertford, St. Albans, etc., and to Edmonton, Tottenham, Kingsbury and Southgate, under E.L. Orders. Also to Met. Elec. Tramways, the Middlesex and Hertfordshire County Light Railways, and to numerous Power Consumers.	15
ion lines 10,000 and 20,000 volts,	3,050 B.H.P.	..	Approx. av. 1d., sliding scale ..	Various	.. .. ..	Quarry supply at 500 volts, 50~, 3-phase. Sec., R. B. Humphreys, Old Bank Buildings, Chester	16
.. ..	.. .. ..	£1,500,000 authorised	.. ..	.. ..	.. .. ..	Acting Secretary, H. S. Frampton, 37, Cross Street, Manchester. The Company has not yet commenced operations	17
.. ..	.. .. ..	..	.. ..	.. ..	.. .. ..	Boiler fired by waste heat and gas from the coke ovens of the Priestman Colliery Owners	18
ormed to 440 v., 50~, 2 and 3-ph.; transformed to 440 v., 50~, 3-ph., nises	.. .. ..	£600,000 authorised	Power 1.25 to 0.75d.; traction, contract	Maximum demand, sliding scale, 2-rate meter and contract	2,000,000	Sec., Ian C. A. Murray, 63, Castle Street, Edinburgh. (Head Office) Commercial Bank Buildings, Kirk Wynd, Falkirk	19
5~, 3 & 1-ph.	12,640 H.P.	..	4½d. to 0.35d.	Sliding scale & flat rate ..	11,548,258	Sec., G. P. Tutcher, Royal Chambers, Queen St., Cardiff. *Cwmbran Station shut down May, 1909; now kept as stand-by only. Cwmbran area supplied from Treforest Station	20
h.; 230 v. 1-ph.; 500 v. D.C. ..	.. .. ..	£398,000	Terms on application	Max. demand	.. .. ..	Address: Thornhill, near Dewsbury. Sec., J. J. H. Stansfield	21

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COMBINATION.